Oct. 1928

Electrical Manufacturing

Vol. 2 A Gage Publication No. 4

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Reputations built on performance are proof even against low-price competition. * * * Every factor in motor performance is bettered by the adoption of Precision Bearings—"NORMA" Ball Bearings, or "HOFFMANN" Roller Bearings, or both. * * * Good motors are made better—and the added cost is insignificant. * * * Let our engineers show you convincing facts.

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PRECISION BEARINGS

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Belden Flexible Armature Wire is used in Leece-Neville armatures. Field Coils are of Cotton Covered Magnet Wire. Connections are made with Belden Lead Wire and all coils in the Leece-Neville Voltage Regulator are of Beldenamel.

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Only the best materials can withstand the severe service to which the starters, generators, and voltage regulators made by Leece-Neville are put on trucks, motor coaches, airplanes, and motor boats.

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Flexible Armature Wire, Beldenamel Magnet Wire, Belden Cotton Covered Magnet Wire, and Belden Motor Lead Wire are some of the items that help them make equipment that endures under this severe service.

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Motor Lead Wires
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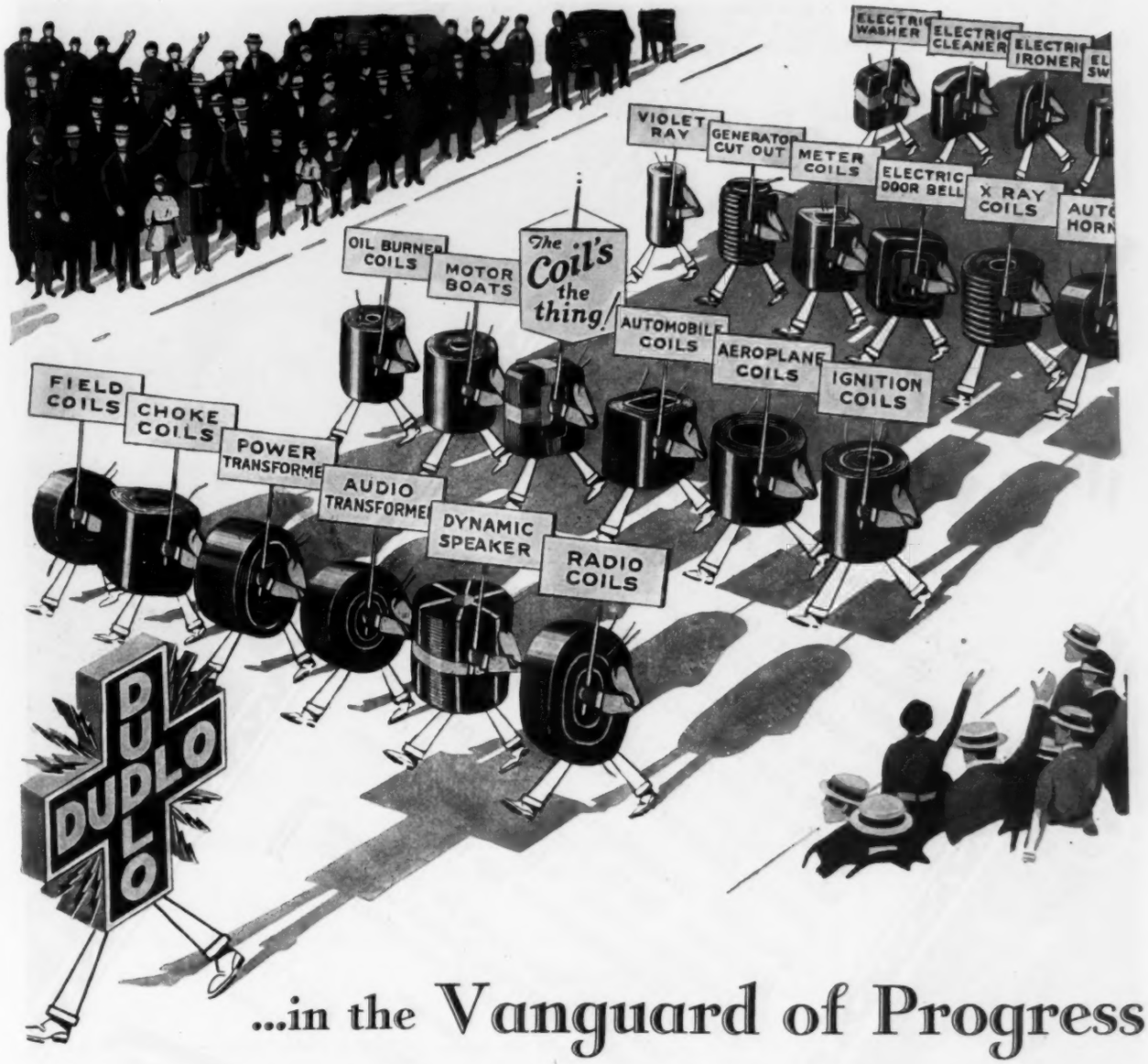

...in the Vanguard of Progress

The Coil's the thing that heads the procession of progress in electrical development. Every engineer knows that no electrical apparatus or instrument is any better than its coils—and they in turn are no better than the wire in their windings.

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Electrical Manufacturing

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Investigator and Interpreter

By GLENN FRANK
President, University of Wisconsin

"THE future of America is in the hands of two men—the investigator and the interpreter. We shall never lack for the administrator, the third man needed to complete this trinity of social servants. And we have an ample supply of investigators, but there is a shortage of readable and responsible interpreters, men who can effectively play mediator between the specialist and the layman. The practical value of every social invention or material discovery depends upon its being adequately interpreted to the masses. Science owes its effective ministry as much to the interpretative mind as to the creative mind. The knowledge of mankind is advanced by the investigator, but the investigator is not always the best interpreter of his discoveries. Rarely, in fact, do the genuis for exploration and the genius for exposition meet in the same mind. The interpreter stands between the layman, whose knowledge of all things is indefinite and the investigator, whose knowledge of one thing is authoritative. The investigator advances knowledge. The interpreter advances progress."

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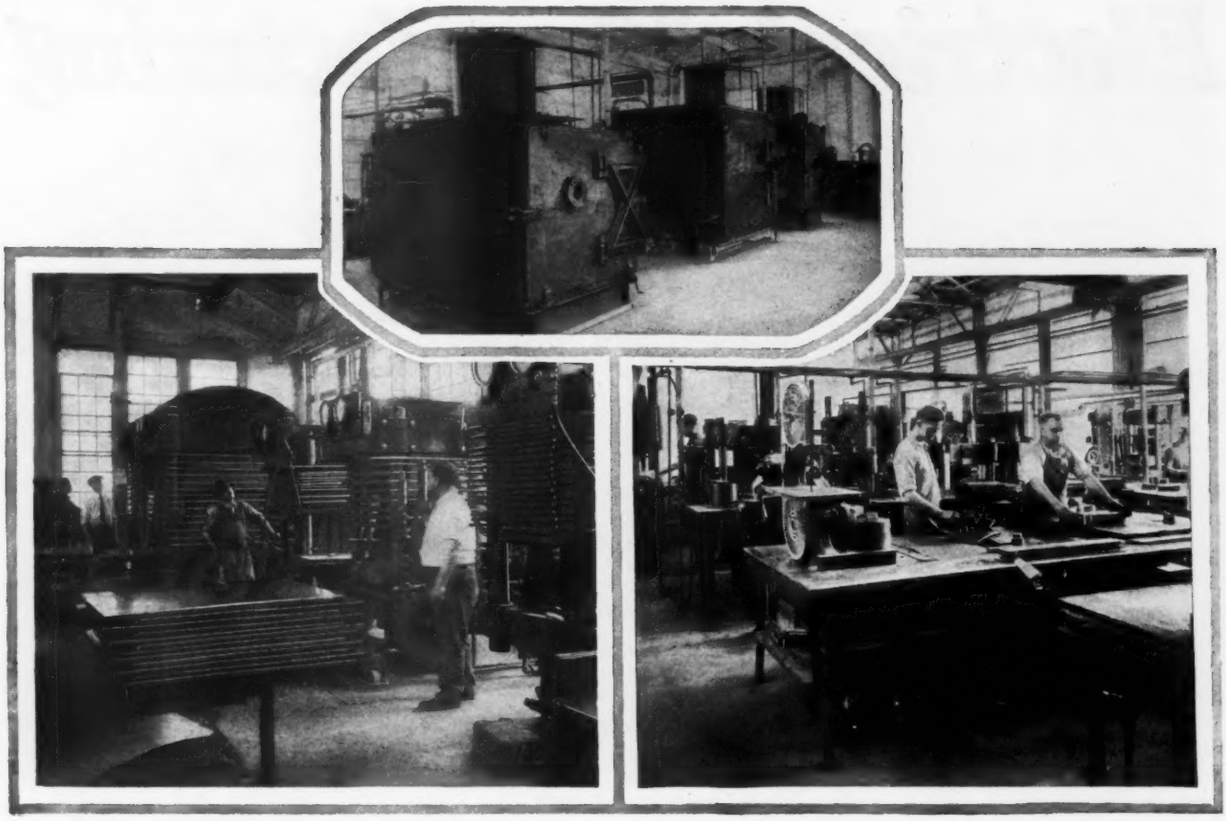

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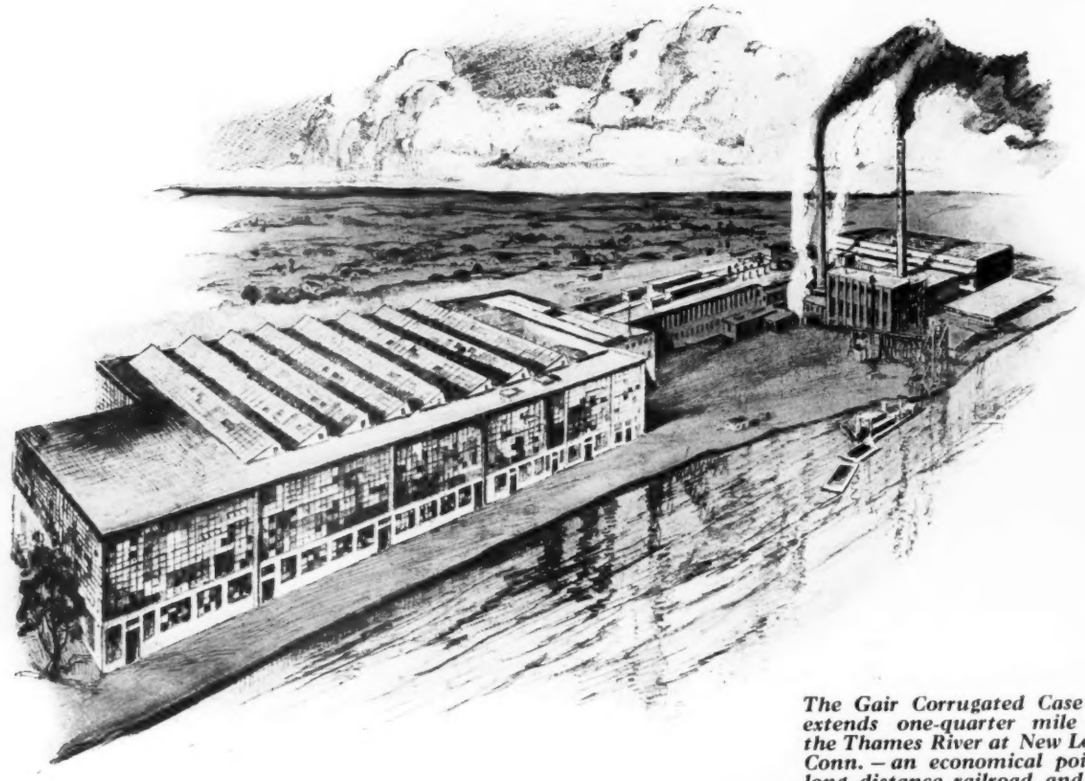
ROBERT GAIR COMPANY

420 LEXINGTON AVENUE, NEW YORK CITY

GAIR CORRUGATED SHIPPING CASES



The Gair Corrugated Case Plant extends one-quarter mile along the Thames River at New London, Conn. – an economical point for long distance railroad and water route distribution.

WE control the whole process of manufacture. Gair Corrugated Cases are produced in the same complex of buildings that house the Paper Mill and Printing Rooms. The Corrugated Case Division enjoys the benefits of the Art Department and Engraving Rooms, which serve the extensive Folding Carton and Display Container Factory, for ideas in design and color—so important to the Corrugated Case as a carrier of advertising.

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ROBERT GAIR COMPANY

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AICO

Standard for Wiring Devices

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The "big things" with us are **doing every job correctly** and retaining the good will and confidence of our clients.

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INSULATOR CORPORATION
420 Lexington Avenue, New York, N. Y.

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No. 38 Foreman's Desk

No. 48-24-50 Low Bed Open Side Truck

ANGLE STEEL EQUIPMENT is a time defying investment.

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ANGLE STEEL EQUIPMENT possesses a big reserve of strength. Designed especially for shop and factory usage, and will be producing dividends long after ordinary equipment has been scrapped. Solidity of construction is a normal specification in every piece of ANGLE STEEL EQUIPMENT.

And ANGLE STEEL EQUIPMENT is designed for comfort too. For every employee, it helps to counteract the "3 o'clock fatigue" — increases production and helps boost profits.

Economical, fire resisting, and sanitary. Your investment in ANGLE STEEL is a wise one. Write for detailed information and prices. We build special equipment promptly to order. We manufacture one of the largest assortments of factory and office equipment. Ask for our new 112 page catalog just off the press. Complete buyers' information on up-to-the-minute equipment.

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ANGLE STEEL EQUIPMENT

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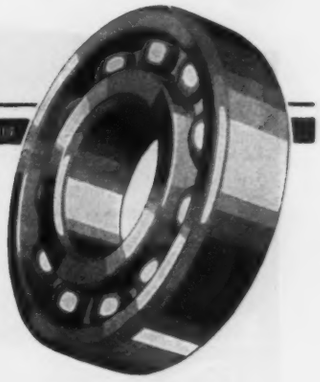


LOUIS ALLIS is one of more than 50 manufacturers supplying general purpose electric motors with New Departure Ball Bearings as either standard or optional equipment.

The air cooling fan shown, is driven by a New Departure equipped Louis Allis motor and is an excellent example of New Departure capacity to carry thrust-radial loads.

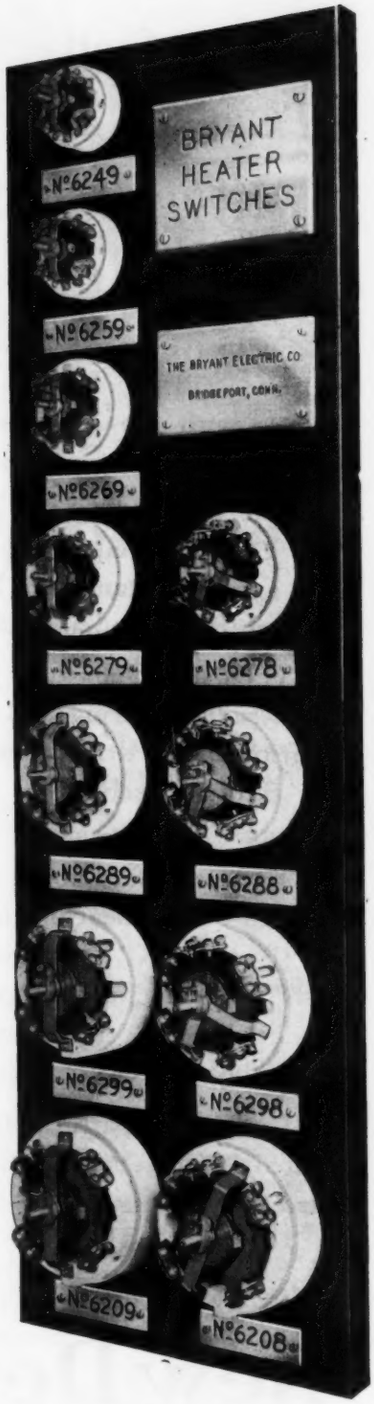
The New Departure bearing is the ultimate thrust-radial bearing and is successfully used in electric motors driving buffers, grinders, sanders and similar mechanisms as well as fans of all types.

To learn more about the advantages of New Departure Ball Bearings in electric motors, write for "Booklet K" (technical) or "Cutting Your Costs" (non-technical), giving data compiled by our Engineering Department from experiences of ball bearing electric motor users.

The New Departure Manufacturing Company, Bristol, Connecticut, Chicago, San Francisco, Detroit.

New Departure
Quality
Ball Bearings

Bryant makes a heater switch for every need



For detailed information relative to your special needs, including a photograph of the type of switch in which you would be interested, address our engineering department.

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BRIDGEPORT, CONN.

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Manufacturers of "Superior Wiring Devices" Since 1888

Manufacturers of Hemco Products

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OCT 22 1928

Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 2 OCTOBER - 1928 Number 4

ADVERTISING RESEARCH

By Paul T. Cherington

ADVERTISING is one of the most widely accepted of modern marketing devices. But it is not an activity apart. It cannot be separated from its environment. The background for any intelligent examination of advertising in these days must include a recognition of modern conditions of supply on the one hand and modern conditions of demand on the other. Fundamentally these may be entirely like those conditions on which the generally accepted economic principles are based, but in their external expressions they show complexities and modified interactions which are relatively new. First of all there is the pressure of all those many influences, in addition to any actual demand for the product, tempting producers to oversupply. Available capital, efficient equipment, a fluid labor supply, easy access to huge markets, a fair supply of administrative brains, and above all plenty of stimulating examples of success, are the sort of incentives constantly at work leading to overproduction. In the second place, many influences of a new type—quite aside from advertising—are at work modifying what might be called the "natural" course of demand. Travel, wide circulation of magazines and newspapers, the reading columns of which command a following, the moving picture, the radio, the automobile, the country club, the tempting offerings of well-stocked stores, the larger surplus for free spending, all make the consumer's will a thing moved by many influences outside of his actual needs.

IT is against this background that advertising of the modern type must be examined. These things would all go on if nobody made any effort to reach consumers with advertising messages. Production is not an activity coaxed hesitatingly from one small venture to another by a well expressed and limited demand; it is headlong and willful plunger, hoping to win a big stake in the business of prophecy as applied on a sweeping scale and backed by ample resources. Consumption is no longer a thing of needs, but a matter of choices freely exercised. The consumer's dollar is not a coin wholly mortgaged to the necessary task of providing a bare living. It has in it a generous segment to be spent at the consumer's own option as to what he will buy, and when he will buy, and where.

To come into this sort of an economic situation and attempt to control the consumer's expenditures, in a measure, by telling him about merchandise for sale may be superfluous, it may even at times be unjustified; but if these messages about any specific goods are true, if the goods are worthy, and if the conveying of the message helps the consumer to choose more wisely, the worst that can be said of the practice is that it is "one more influence," and it may be a veritable godsend in a Babel of urgency.

ADVERTISING research is a form of market research—it could not have developed in an age of under-production, and it would find meager material in a market made up of marginal consumers. But in present conditions of production and consumption, there is room for unbiased knowledge of the workings of this force for the modification of demand. And it is this which advertising research is called upon to produce.

The responsibilities of advertising research are the responsibilities falling on any research: to find the truth no matter how obscure, to recognize it no matter in what strange form it may present itself, to formulate it honestly, to state it unmistakably, and to reason from it remorselessly and without regard to prejudices.

Guiding Industry *to*

How the National Industrial Conference Board studies economic conditions and industrial experience to aid American business

THE National Industrial Conference Board was organized in May, 1916, by progressive industrial executives who believed that the industrial and economic development of the United States could be materially furthered through comprehensive, impartial study of economic conditions and industrial experience, and through discussion of the facts found and the presentation and dissemination of these facts and of well-considered views based thereon.

In this manner the Board seeks to contribute to the solution of American industry's economic problems and to the evolution of constructive business and legislative policies. In the execution of this program the Board enjoys the affiliation of important national and state industrial associations, and of Federal government bureaus concerned in industrial production, as well as the counsel of specially selected persons of wide experience and broad judgment. At present 23 national associations, four state associations, and four Federal bureaus are affiliated with the Board.

Each affiliated national or interstate association and each Federal bureau is entitled to designate from its own membership two, and each affiliated state association one individual owner of an industry, or a partner, officer or chief executive engaged in industrial production, as members of the Board.

Qualified representatives of financial supporters contributing over a certain amount also are eligible to membership. In order to bring to the Board the best judgment obtainable in respect to its work and policy, the Board, upon unanimous suggestion of its executive committee, elects councillors from among outstanding persons in any walk of life of whose knowledge, experience and judgment the Board may desire to avail itself.

THE National Industrial Conference Board is one of several organizations which are rendering important service to American industry, including, of course, the electrical manufacturer. The work of a number of similar organizations will be described in future issues of ELECTRICAL MANUFACTURING.

THE EDITOR

The present régime of intense competition in efficiency and of "rationalization" has brought with it many deep-cutting changes in industrial methods and business policies, and has brought about a situation in which none but the most wisely planned and prudently and economically executed business operations may be expected to succeed. The past year, the twelfth fiscal year in the existence of the Board (May, 1927, to May, 1928) was a period typically illustrative of the Board's opportunity to demonstrate to industry and business its value as a clearing house for analyzed industrial experience and information, and as a forum for discussion of their economic significance.

The many problems arising out of the changing and often apparently paradoxical trends in our economic evolution, clearly emphasize the growing necessity for continuous scientific and practical economic research. It is the task of the Board's research staff scientifically to analyze important, timely economic problems affecting business conduct, by collecting all available pertinent material, and by giving it practical interpretation for the guidance of industrial and business executives in the shaping of their business policies, and for the information of the public and their legislative representatives, to aid them in formulating their judgment and public action.

Developments during the past few years have made it increasingly evident that wage reduction is no longer the first move of industrial management when retrenchment in expenses becomes necessary. Existing wage scales, in the main, in recent years have successfully withstood periods of cyclical depression, such as were experienced in 1924 and 1927, evidently because industrial management considered it preferable to maintain consumer purchasing power and satisfactory relations with its employees.

Board Studies Are Published

THIS policy reflects a new economic orientation and a type of industrial statesmanship characteristic of the direction of American social-economic progress. In view of the importance that is thus attached to wage earning in American industry, the Board has carried forward its monthly studies of hourly and weekly wage earnings in industry, and of the cost of living in the United States as a factor in determining the purchasing power of these wage earnings. The hours of work and the trend of employment also form an important part in these investigations.

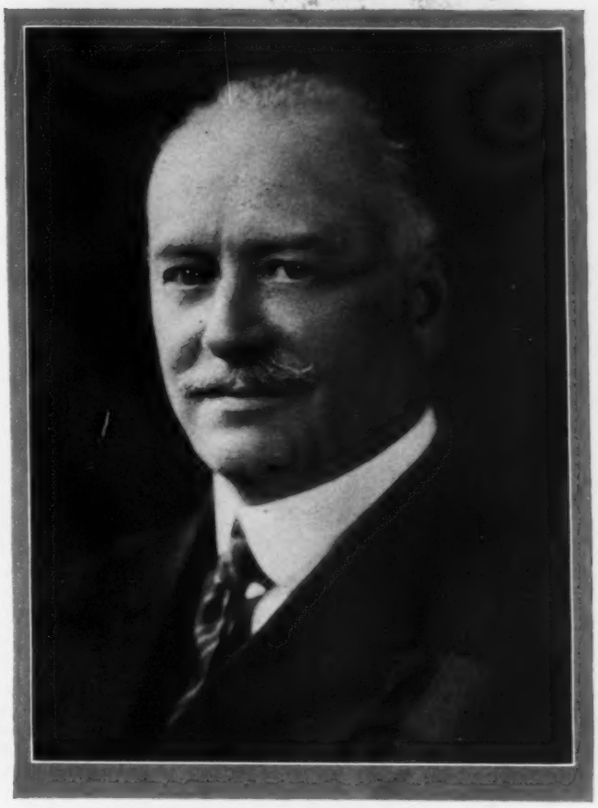
The results of these monthly studies were published in "The Conference Board Bulletin" during 1927, and in 1928 they appeared in the newly issued "Service Letter on Industrial Relations." In addition, the Board published during the past fiscal year books on: "Wages in the United States, 1914-1927," "The Cost of Living in the United States, 1914-1927," "The Cost of Living in Twelve Industrial Cities."

An important factor in the balance of production and consumption during recent years has been the purchasing power of the farmer. The Board's recognition of the importance of a prosperous agriculture as a part of our national economy and of the decline of the economic status of the farmer after the World War, as set forth in the Board's report, "The Agricultural Problem in the United States," issued two years ago, did much to focus wide attention on this national issue and resulted in an extensive investigation into the agricultural problem by the Business Men's Commission on Agriculture, organized by the National Industrial Conference Board in conjunction with the Chamber of Commerce of the United States in October, 1926. The report of this commission, containing findings and recommendations arrived at after a year's intensive study and hearings given to 170 witnesses

to Profit *by the* Facts

By Magnus W. Alexander

President, National Industrial Conference Board



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Magnus W. Alexander

from 34 states and the District of Columbia, was published jointly by the Conference Board and the National Chamber in November, 1927, under the title: "The Condition of Agriculture in the United States and Measures for Its Improvement."

The past year has witnessed a marked expansion in the Board's researches in the field of taxation and public finance. Three studies in this field were completed and work is progressing on three others of importance.

The Board's annual report on "The Cost of Government," in addition to presenting complete expenditure, debt and tax figures for the country as a whole up to July, 1926, includes valuable studies on the social and economic distribution of the country's tax burden, on school and highway finance, and on taxpayers' associations.

When revision of the Federal tax law was contemplated by Congress, the Board published in December, 1927, a monograph entitled "Proposals for Changes in the Federal Internal Revenue System," concerned with such immediate improvements as seemed to be feasible and practicable in view of the pressure of fiscal obligations upon the Treasury Department.

Income Tax Investigations

THE Board's study of "The Shifting and Effects of the Federal Corporation Income Tax" has provided the material for two separate books of research, involving one of the most extensive statistical investigations undertaken by the Board, in the course of which the income tax reports of 4,644 corporations over a period of eight years were thoroughly analyzed. The question to which an answer is sought in this investigation is whether and to what extent the Federal corporation income tax is being shifted. One of the two investigations has been completed. It deals with the shifting and effects of the Federal corporation income tax on manufacturing and mercantile establishments; the other, dealing with the same subject in respect to public utilities, mining and financial corporations, is in process of completion. A valuable by-product of this investigation of the incidence of the tax is the analysis of the distribution of sales and of capital investment by profit ratios for each industry during the post-war period.

The following books of research in the field of taxation and public finance were issued during the fiscal year 1927-28. "The Cost of Government in the United States, 1925-1926," "Proposals for Changes in the Federal Internal Revenue System," "The Fiscal Problem in New York State," "The Shifting and Effects of the Federal Corporation Income Tax, Volume I (Manufacturing and Mercantile Establishments.)"

As a result of first-hand information in Geneva, Switzerland, in 1921, and subsequent study of the work of the then only two-and-a-half years old International Labor Organization, established by the League of Nations under the sanction of the Treaty of Versailles, the Board published, in April, 1922, a book giving an account of the structure and operation of this important international body. During the last year the Board undertook a comprehensive examination of the work and accomplishments of the International Labor Organization. The Board's publication on this subect is entitled, "The Work of the International Labor Organization."

The Board has nearly finished an exhaustive study of the consolidation movement in American industry. It analyzes, on the one hand, the comparative business success of industrial mergers and independent concerns and their effects upon prices, productive efficiency and industrial stability, and, on the other, records the history of court decisions under the Sherman Act, the Clayton Act and other supplementary anti-trust legislation, and traces the economic thought involved in these decisions affecting industry.

The Board is now studying the application of the anti-trust laws to labor organizations and other economic combinations of similar character. These two researches when completed will add two books of value to the two volumes already issued, namely: "Trade Associations: Their Eco-

The National Industrial Conference Board Officers and Executive Committee

Loyall A. Osborne
Chairman

LOYALL A. OSBORNE, president, Westinghouse Electric International Co., New York, is chairman of the National Industrial Conference Board. Other Officers are: Hon. chairman, Frederick P. Fish, Fish, Rchardson and Neave, Boston; vice-chairman, Charles Cheney, president, Cheney Brothers, South Manchester, Conn.; Irénée du Pont, chairman finance committee, E. I. du Pont de Nemours & Co., Wilmington, Del.; Herbert F. Perkins, first vice-president, International Harvester Co., Chicago; and George S. Harris, president, Exposition Cotton Mills, Atlanta.

The executive committee consists of the officers just named and Magnus W. Alexander, president; Fred I. Kent, treasurer, who is a director of Bankers Trust Co., New York; William D. Baldwin, chairman, Otis Elevator Co., New York; A. Farwell Bemis, chairman, Bemis Brothers Bag Co., Boston; and Cornelius F. Kelley, president, Anaconda Copper Mining Co., New York

nomic Significance and Legal Status," and "Public Regulation of Competitive Practices."

The importance of all activities affecting employer-employee relationships in present-day industry is recognized by the Board in its maintenance of a special department for the study of problems in this field. The Board has assembled a comprehensive body of data bearing upon industrial relations activities in nearly 5,000 plants in the United States, and it is constantly adding to these data in order to build up a clearing house of information which may be called upon for assistance in solving the problems of individual concerns, as well as in determining broad policies of industrial relations.

The Board has published three monographs dealing respectively with "Industrial Group Insurance," "Night Work in Industry," and "Supplemental Bonuses for Wage Earners, Supervisors and Executives." Although industrial group insurance has been in effect a relatively short time, it has grown rapidly, and it is estimated that today about 5,000,000 wage earners are covered by group life insurance for a total of more than $6,000,000,000. The tendency seems to be for still greater expansion of this form of organized protection for wage earners; but the tendency also seems to be in the direction of combining different forms of group insurance, such as life, sickness and accident insurance, into a one policy arrangement.

Although industrial relations activities have been associated mainly with large establishments, the Board has noted a growing interest on the part of small concerns in this subject, particularly in activities aimed at the improvement of the wage earners' economic position. These smaller concerns recognize that the size of the organization has no bearing upon the employees' desire to secure the benefits of group insurance, to enjoy a pension provided at the expiration of long and faithful service, or to participate in various other industrial relations activities which are intended to stimulate and reward efficiency and morale, faithfulness and loyalty, aside from the payment of wages and bonuses. The Board is compiling material upon this significant development, and in its report on "Industrial Relations Programs in Small Plants" will provide data on an aspect of industrial relations activities which has heretofore received but scant attention. In addition, the Board is preparing a book on "Administration of Industrial Relations Activities," based upon the practices in over 4,000 establishments throughout the country.

The following books on industrial relations subjects were issued by the Board during 1927-28: "Industrial Group Insurance," "Night Work in Industry," "Supplemental Bonuses for Wage Earners, Supervisors and Executives," "Employee Stock Purchase Plans," "The Economic Status of the Wage Earner in New York and Other States."

Since the World War the international economic position of the United States has changed from that of a debtor to that of a creditor nation, a change which will inevitably make itself felt in our domestic as well as international industrial and trade relations—in fact, throughout our entire national economy. The Board has undertaken the following studies: "The Present International Financial Position of the United States," an analysis of the changes in the international financial position and business transactions of the United States in recent years; "The Foreign Trade of the United States," a study in which the changes in position and distribution of our foreign trade are analyzed for the purpose of trading the probable effects of our credit position upon our foreign trade; "The American Merchant Marine Problem," and "Current Tendencies in Organization and Methods in European Industry."

European governments have shown a growing tendency to foster industrial development and trade expansion by a special governmental regulation and assistance in the form of subsidies, government ownership and control, tariffs and the like. These developments are analyzed in a study now under preparation, "Recent Developments in Governmental Policies Toward European Industry and Trade."

The Board is also concerned with such subjects as "The Shifting and Effects of the Federal Corporation Income Tax," "General Sales or Turnover Taxes," "Capital Expenditures and Public Indebtedness," "The Development and Problems of State Income Taxation," "The Cost of Government in the United States, 1926-1927," "The Standardization Movement in American Industry," "The Working Population of the United States," and a number of studies of specific industrial relations and labor problems.

Changing methods of production, distribution and transportation, and changes in the structure of our financial system, as for instance intensive mass production, hand-to-mouth buying, installment purchasing, and the reorganization of our credit structure under the Federal Reserve System, evidently have brought about the necessity of a re-

(*Continued on page* 201)

Our Battery Exports *Amount to Millions*

Flashlight, storage and primary batteries in hundreds of thousands are shipped annually to practically every foreign country in the world

By Edward L. Bacher*

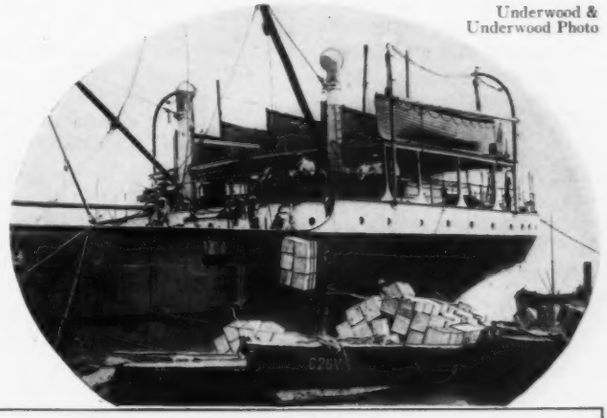
Manager, Foreign Commerce Department, United States Chamber of Commerce

Harris & Ewing Photo

Edward L. Bacher

FEW products have more of a world-wide distribution than do batteries. This was true even before the recent years when automobiles and radios have made batteries a well known necessity of commerce, even among the uncivilized peoples of the world. I recall that previous to the World War, out in Java and Sumatra, we were wont to think that Standard Oil and Singer Sewing machines represented the most ubiquitous products of world trade, being found in practically every little hamlet. But yet as I think back of those lazy days, when we spent our spare hours in that hot tropical climate lying on easy chairs and counting the number of days before we would be able to see snow again, right at our elbows there was a push button connected somewhere with a battery that rang the hotel bell whenever we needed more to eat or drink. I recall also that during some of these torrid summer nights when we couldn't sleep because mosquitoes had found their way inside the mosquito net which we had over our beds, it was an American flash light, equipped with American batteries, that helped us to find and dispatch the unwelcome intruders.

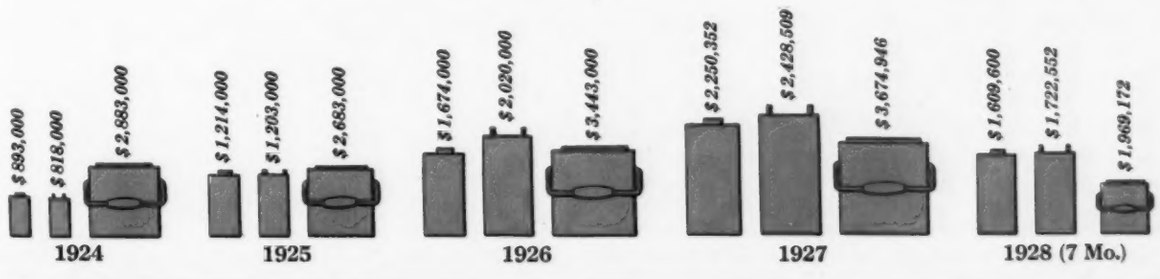
It is no surprise, therefore, to find that the export records of the United States show batteries going to practically every country in the world, and in discussing the export



Underwood & Underwood Photo

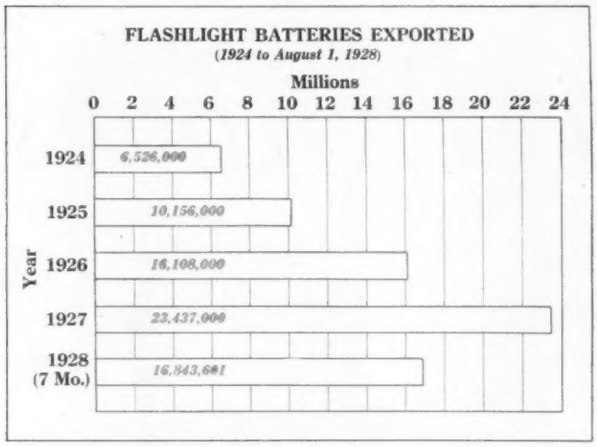
* *Excerpts from an address delivered by Mr. Bacher at the 1928 annual convention of the National Battery Manufacturers' Association, Inc., at Atlantic City, September 20.*

VALUE OF FLASHLIGHT, PRIMARY AND STORAGE BATTERY EXPORTS
(1924 to August 1, 1928)

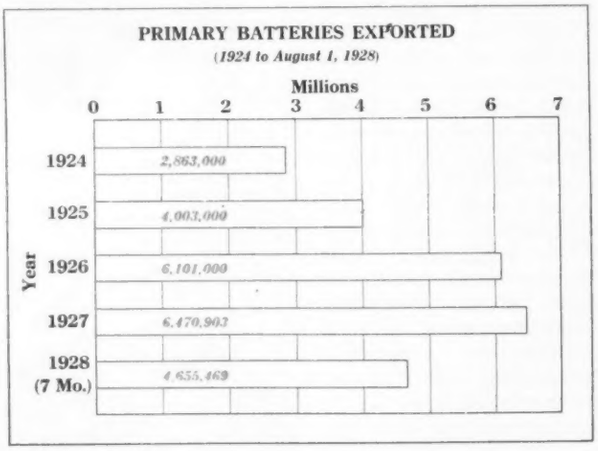


Maps and charts were prepared by Electrical Manufactuing *from statistics of the United States Department of Commerce*

market for batteries I believe it will be helpful to give a brief glance at those markets from the following points of view: (1) How export business has grown; (2) where the markets are and how to reach them; (3) what the present conditions are there; and (4) some suggestions as to methods of financing, packing, etc.



The growth of the battery export business has been one of the remarkable features of our overseas trade. In 1914 we exported $636,000 worth of batteries. In 1927 that figure had reached the enormous total of $8,352,000. In other words, exports of the battery industry in a period of thirteen years have increased over thirteen fold. The business had more than doubled in the year 1915 the 1914 figure, making a two-year average of about $1,000,000 worth of batteries shipped overseas annually.



If you will take the figures of exports for the five-year period from 1921 to 1925, you will find that that two year average on $1,000,000 has been multiplied pretty nearly four times. An average of $3,940,000 worth of batteries was shipped out of the country annually during those five post-war years.

Even more remarkable has been the developments during the past year, 1927. The total exports during that year reached $8,352,000 or double the average for the five-year period just mentioned. And in the first six months of 1928 the exports reached $4,591,000, promising that 1928 will break the 1927 record. In fact the first half year's exports for 1928 are pretty nearly the same amount as the exports for the full year of 1924.

These figures are positive proof that manufacturers have not been blind to the great opportunities the export fields offer. Especially in figures having to do with international trade, it is necessary to guard against taking value figures as true indices of business gains or losses. Let me cite some of the striking quantity increases in our export trade in batteries, which will fully substantiate the value figures just given. For instance, in the export of flash light batteries we find that there has been a phenomenal increase. From an export of six and a half million flash light batteries in 1924 the figures have jumped to 10,000,000 in 1925, 16,000,000 in 1926 and 23,500,000 in 1927, with over 15 and ½ million batteries already exported in the first half of 1928. In other words, in the first half of 1928 the exports had nearly reached the 1926 yearly total.

A similar situation applies in the exportation of other primary batteries, the figures jumping from 2,800,000 in 1924 to 4,000,000 in 1925, to 6,000,000 in 1926 and to nearly 6,500,000 in 1927, with the exports of the first half of 1928 reaching nearly 4,000,000 batteries.

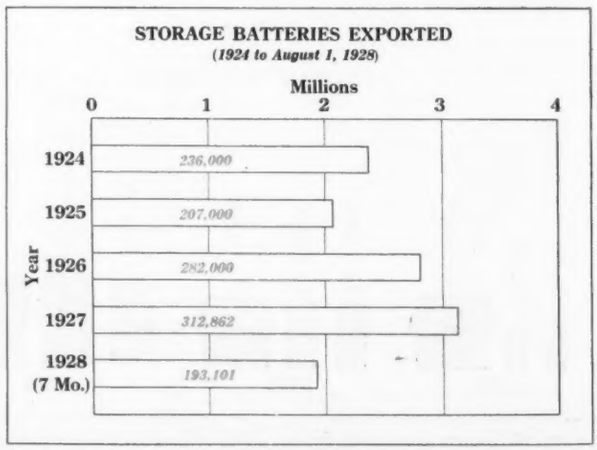
In the exportation of storage batteries, while the record is not quite as startling, there has been a firm increase from 236,000 in 1924 and 207,000 in 1925 to 282,000 in 1926, 302,000 in 1927 and 150,000 in the first half of 1928.

The 1927 exports provide interesting conclusions, 80% of the flash light batteries sent from this country during that year, went to the following ten countries: 1. Argentina (14.4%); 2. British Malay (13.2%); 3. British India (13%); 4. Philippine Islands (9.7%); 5. Hong Kong (9.6%); 6. Mexico (5.4%); 7. Australia (4%); 8. Colombia (4%); 9. Venezuela (3.9%); and 10. New Zealand (3.3%).

Over 81% of the exports of other primary batteries during the year 1927 went to the following ten countries: 1. Australia (28.9%); 2. Argentina (21.4%); 3. Canada (6.3%); 4. Mexico (5.2%); 5. New Zealand (4.9%); 6. United Kingdom (3.3%); 7. Brazil (3.3%); 8. China (3%); 9. Cuba (2.6%); and 10. Uruguay (2.4%). In other words, over half of the 1927 exports in this class went to the two distant markets of Australia and Argentina.

In the exports of storage batteries the distribution is not quite so heavily limited to the larger countries. About 68% of the exports of storage batteries went to the ten leading countries as follows: 1. Australia (12.1%); 2. Argentina (11.6%); 3. Union of South Africa (11.4%); 4. Canada (8.1%); 5. New Zealand (6%); 6. British India (4.8%); 7. Chile (3.9%); 8. Brazil (3.8%); 9. Mexico (3.3%); and 10. Cuba (2.9%).

To the manufacturer who has been in the export business for some time his ledger accounts give him one of the clearest pictures of trade conditions, as regards American exports, in the various foreign markets with which he deals. For the American battery manufacturer who does not have such ledger accounts but who would like to have them, the United States Government

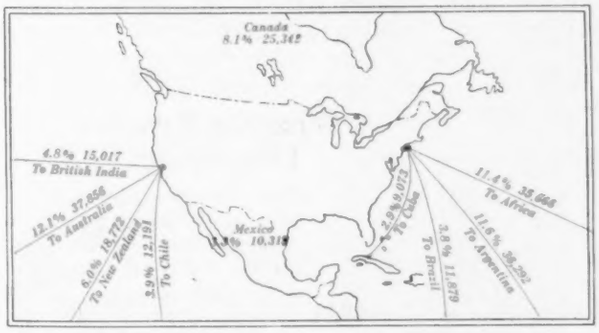


offers an excellent service. Undoubtedly all of the manufacturers of batteries who have had some contact with overseas trade have at some time been in touch with the Electrical Equipment Division of the Government Bureau of Foreign and Domestic Commerce. Through the commercial attachés and the trade commissioners of the Bureau, who are scattered throughout all of the important countries in the world, the Government Bureau has facilities for gathering information about conditions relating to any of the important American products being sold abroad.

The Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce in cooperation with the Commercial Intelligence Division of the Bureau can make available to American concerns names of importers in all of the important foreign markets, who might be interested in the importation of batteries. Manufacturers wishing to obtain such information should take steps to have their names listed on the Exporters' Index of the Bureau, which is a card file of firms engaged in foreign trade who have satisfied the Department of Commerce that the control of their capital stock and their directors are American. The lists obtainable through that channel give some indication as to the character of the business of the house mentioned, its nationality, size and relative importance.

In the National Chamber we have also a Foreign Commerce Department Advisory Committee, composed of men prominently connected with various phases of export and import business and representing various sections of the country. At the meetings of that committee, important matters of foreign trade legislation and foreign trade policy are discussed and we are always glad to receive from any organization or concern suggestions as to matters which the committee might well consider. Any manufacturers who are at present dealing with Cuba have doubtless run into the difficulty which has prevailed since March 1, 1928, when Cuba cancelled the parcel post arrangement with the United States because of the failure of Congress to remove certain restrictions on the importation into the United States of cigars and cigarettes. I cite this as one example of the many important matters which have had committee consideration and which the National Chamber is working to solve.

STORAGE BATTERIES

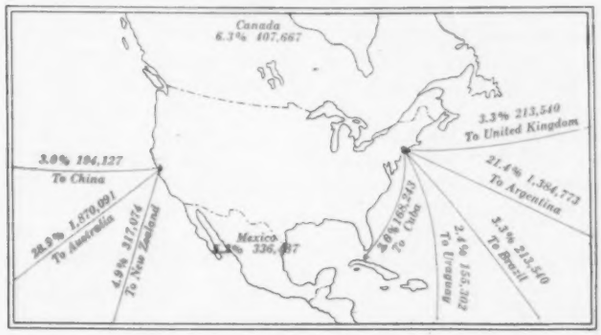


It has been suggested that some discussion of the methods of financing export trade would be helpful. The battery exporter ordinarily desires to get payment for his merchandise as quickly as possible and to safeguard himself against loss by retaining security for payment. On the other hand, the purchaser in the foreign market may demand some extension of credit—a factor which the foreign battery manufacturer may be making a competitive weapon. Trade practices in the matter of financing and credit vary with different markets and with the different customers.

FLASHLIGHT BATTERIES

The first step for the beginner in exporting is to consult with his bankers not only with reference to the arrangement of the proper credit but also with regard to the handling of drafts and other financing instruments and the checking of the credit standing of his customers. The foreign battery buyer may ask that shipments be made against drafts. Drafts may be payable at sight or payable a certain number of days after sight or a fixed number of days after date. Ordinarily negotiable documents covering the shipment must be attached to the draft. If the credit standing of the battery manufacturer warrants it, his bankers will usually advance a large proportion of the full amount of the draft with recourse to the exporter pending final payment.

PRIMARY BATTERIES



The smooth handling of export business makes it necessary that there be a full understanding between the exporter and the foreign buyer as to who is to pay such items as interest, bank collection charges, consular fees, etc. The manufacturer's bank should have complete instructions as to what the bank's foreign correspondent is expected to do in case of refusal to accept or pay the draft. Before extending credit to his foreign customers, the battery manufacturer wants to assure himself that they are worthy of it. He has available to him not only the trade information reports of the government Bureau of Foreign and Domestic Commerce, but also the credit reports of the larger credit agencies, of the foreign trade banks and of various other sources both at home and abroad.

The export packing of batteries, particularly the storage battery of the rubber-cell type, presents a number of interesting problems. Irrespective of the type of battery he manufactures, the battery producer must decide the most economical packing that will provide full protection for his goods; that will serve the interests of his customers in meeting the customs requirements of the country of destination and that will create as much sales value as possible in the quality and appearance of the packing.

Interesting facts and other general information relative to the packing of commodities for overseas shipment may be obtained from such publications as a book entitled "Packing for Foreign Markets," published by the Bureau of Foreign and Domestic Commerce.

Modern Machines Make

Better Lamps— Lower Prices

More efficient machinery in less factory space increases output, improves quality of lamps and multiplies their retail sales

SCIENCE and exploration into the secrets of Nature today hold the world stage. The marvels of aviation, of television, of talking movies are on every lip, on every newspaper front page. But the marvels of modern engineering, and the organization of machinery to do more and more of man's work at steadily decreasing cost, receive little publicity.

The invention of the incandescent electric lamp in 1879 created far more of a stir in the world than will the price reduction of 1928 or the publication of this story about it, yet the number of lives affected by that invention during the following ten years was far less than the number which will be affected by the present price reduction during the coming year.

It is only the improvements made upon Edison's invention and particularly the improvements made in the machinery which produces lamps, permitting continual price reductions, which placed the incandescent lamp where it influences the lives of millions.

To the scientists whose researches and analyses are continually improving the Mazda lamp, society owes a great debt, but to the unsung engineers and unpraised mechanics whose skill in improving lamp machinery has steadily brought down the cost of lamps, society owes perhaps an even greater debt.

The July 1 price reduction is the twelfth reduction since 1921. It is a reduction which brings the average price of lamps down to almost half of the average price seven years ago. It averages 14 per cent on lamps affected, which constitute 82 per cent of the demand. The new prices will save the American public $8,500,000 annually.

Here is what the engineers have done since 1921:

1—Tripled the capacity of each operator by improvements in machinery. Can you hear the machines singing at a higher pitch?

2—Decreased the factory floor space required to manufacture lamps to *one-third the space needed in* 1921. Can you see the stacks of money that reduction saved in overhead?

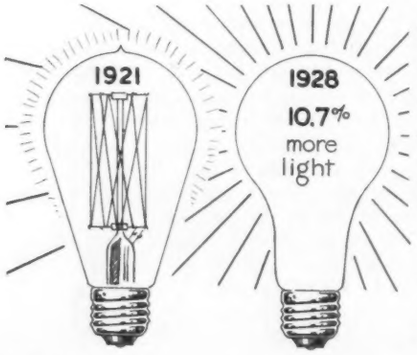
Changes in Factory Layout

SEVEN years ago, if you had entered a lamp assembly factory, you would have found it divided into several departments all doing some one operation in the assembly of the lamp. You would have seen big storage racks in each department to take up the surplus when one department's production got ahead of the one next in line.

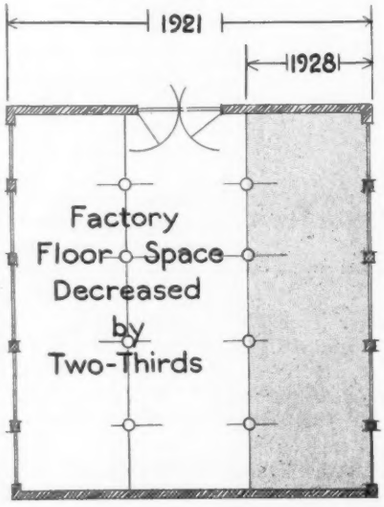
A year ago you would have found one machine doing every one of the operations from start to finish, and fed by from three to seven operators. The old departments would have vanished and the space wasting storage racks between them.

Today you would find the marvelous

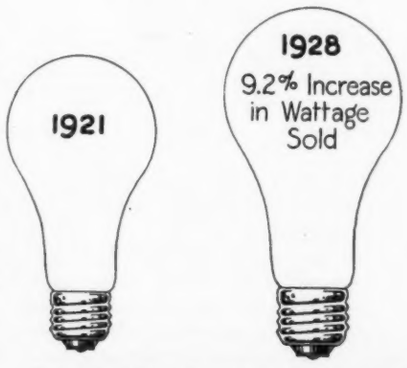
What the Consumer Has Gained



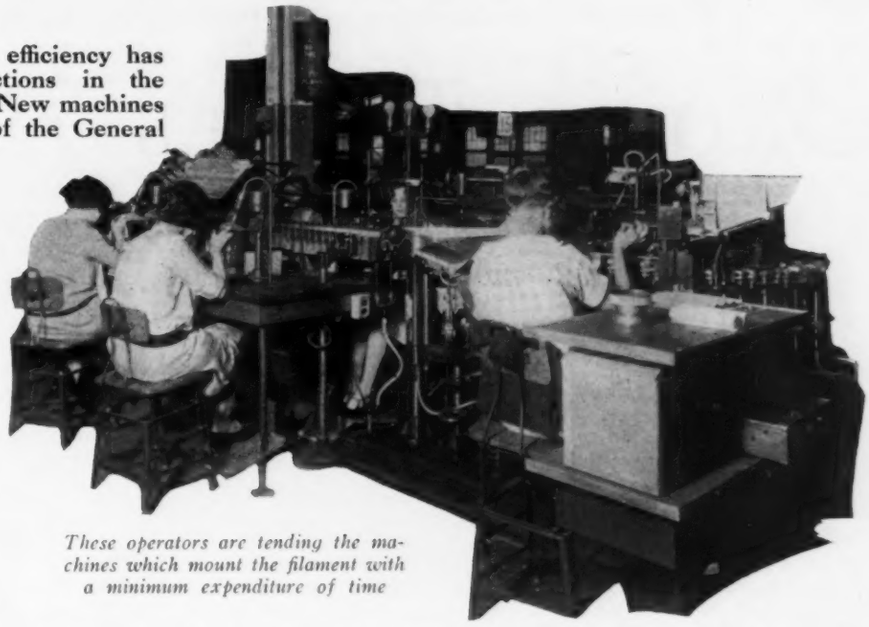
How Overhead Costs Have Declined



What the Retailer Has Gained



INCREASED factory efficiency has made several reductions in the prices of Mazda lamps. New machines in the Newark factory of the General Electric Company increased production by 50 per cent in the five months period from November, 1927, to March, 1928, and at the same time the quality of the product has improved



These operators are tending the machines which mount the filament with a minimum expenditure of time

machines of last year scrapped, and more wonderful, more efficient machines in their place. If you were in the Newark factory of the General Electric Company, you would be told that these new machines had increased production by 50 per cent in the five months period from Nov., 1927, to March, 1928! When you saw these things you would no longer wonder how prices could be reduced so fast. You would only wonder that man's brain could devise such extraordinary automatons.

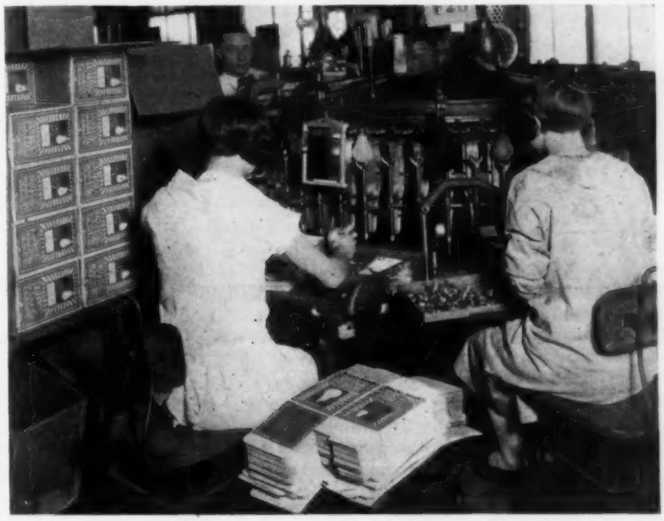
With all this speeding up and cutting down you might be somewhat skeptical of the quality of the product turned out. Speeding up human beings usually means less perfect work. But with machines the rule of decreased quality with increased speed of operation does not hold. Machines do not tire and they do not have to think faster. Therein lies the difference.

Increased Lamp Quality

IF you are dubious, consider these facts. In the seven years, 1921-1928, the quality of the Mazda lamp has been so far improved that today it is 10.7 per cent more efficient, that is it gives 10.7 per cent more light for the same amount of current consumed in 1921. When you consider that nine-tenths of the cost of lighting is in the cost of the current, it is easy to see how much more the public now gets for its money.

Some of you will wonder how the Edison Mazda lamp agent has gained by all these things. In the first place, improvements in Mazda lamps, extensively advertised, have increased lamp sales. In the second place, reduced prices have increased lamp sales. The two working together have so increased public demand that in 1927 nearly twice as many Mazda lamps were sold as in 1921. In 1921 170 million lamps were sold, while in 1927 nearly 320 million were sold!

The agent has also had the benefit of automatic machinery placed at his disposal to speed up sales. Consider the sleeve displays provided for agents in recent years on a cooperative basis. Consider how concentration on the idea of carton buying has saved agents' time in selling.



Fastening the base to the neck of the bulb, final inspection and placing the finished lamp in a wrapper

Price Reductions Benefit All

CONSIDER this fact also, advertising of the advantages of the use of more light, and concentration upon the sale of 50- and 60-watt sizes have increased the wattage of the average lamp sold from 54 watts to 59 watts, or 9.2 per cent. The value of lamp sales has, of course, increased in proportion.

From the foregoing it is seen that all concerned with lamps have gained by price reductions; the agent has gained through increased sales and the sale of higher wattage lamps; central stations have gained through higher wattage and the load added by the increased use of lamps; the manufacturer has gained through decreased costs and increased volume of sales, and the public has gained by decreased cost and improved quality.

The marvelous accomplishments of engineers in improving the quality of lamps, increasing production and releasing valuable floor space in lamp factories is a striking example of what is being done throughout the plants of electrical manufacturers. The use of modern conveyor systems giving straight-line production, up-to-date machine tools and many other similar pieces of equipment have made possible enormous strides in increased production.

These improvements in present-day production methods have enabled other electrical manufacturers to reduce prices on their products in the same manner that the lamp manufacturers have reduced the prices of lamps. All these changes in production methods indicate the important place in modern industry held by the engineer.

Economic Considerations that Increase the Complexity of the

Motor Buyer's Problem

From the commercial standpoint, the selection of motors for motor driven products is largely dependent on the field to be served by the maker

By H. L. Hildenbrand

Engineering Editor, Electrical Manufacturing

MANUFACTURERS of motor-driven machines face a problem of major importance when they "go on the market" to purchase motors for their equipment. There are so many makes of motors which will stand up satisfactorily in the field that the problem becomes most complex. Failure to take into account all of the factors involved and to obtain a comprehensive picture of the technical and economic considerations governing the selection of a motor for a particular product may mean the difference between staying in business and being forced to quit. This article takes up the commercial considerations from the standpoint of the motor buyer.

Field To Be Covered

The group of companies making motor-driven equipment seems to divide itself quite logically into two groups. One group is making a product which is to be sold only in a limited territory. The other group makes products which it wishes to sell throughout this country, and possibly in foreign countries. The first group often finds that it is desirable to deal with a smaller manufacturer of motors, because the smaller maker can furnish the motors more quickly, and, since this group probably will not want a great number of motors, the price may be less. Another point which is considered of primary importance by some of this group is the fact that if they deal with a manufacturer close at hand they can make adjustments, obtain replacements and spare parts much more quickly than they can from some larger company farther away from their particular factory.

Since the service problem of these manufacturers selling in limited territory is confined to the same district, it is a simple matter to adjust customer complaints because of the nearness of the motor manufacturer. Considering the other group, which by means of a large sales organization intends to sell its machines throughout a large territory, the problem assumes a slightly different aspect. The location of the manufacturer of the motors here becomes of lesser importance and the problem of replacements, spare parts, etc., comes to the front. If this manufacturer does not wish to maintain his own service stations throughout the country and equip them with tools and men that can repair the machines, both electrically and mechanically, arrangements must of necessity be made with the motor manufacturer to handle such problems. The smaller motor manufacturer is, in some cases, not equipped to handle the service problems of its motor buyer customers because it does not maintain service stations throughout the country.

An example of this is shown in the arrangement maintained between one maker of motor-driven machine tools and the motor manufacturer supplying him. Salesmen are located centrally in different territories, so that it is easy for them to call upon new customers and answer service calls from old ones in their section. When a complaint comes in, the salesman goes out and inspects the machine in question. If the trouble is mechanical, the salesman fixes it or gets the new parts for it. If it is motor trouble, he explains it to the customer, and on his return to the office he calls up the local service station of the motor manufacturer. A motor repairman is sent out to the job and the motor is repaired at once. The responsibility for placing the machine in operation again falls on the manufacturer of the machine. To the customer, it is just plain service. To the manufacturer of the machine it means a satisfied customer, and, in addition, it means that he is receiving service from the motor maker in return for the price paid for the motor. For this group of manufacturers it is obviously worth a few dollars more in the original motor cost to have the benefit of service throughout the country.

Motor Prices

This brings us to the subject of price. Too many motor buyers are influenced by price alone, even to the point of almost total disregard of such things as service. It is well to investigate thoroughly just what is being obtained from the motor manufacturer for the price he asks. One maker may offer his motor for a certain price and another maker may ask 30 per cent more for the same motor purchased in the same quantities. Investigation of the two motor makers and thorough tests of the motors should reveal the reason for the difference. Assuming that both companies are reliable and will be in business when, several years hence, spare parts or replacements are required, the company which will make the best ageement to meet such contingencies should get the business.

The idea exists in the minds of too many manufacturers of motor-driven apparatus that they can apply a motor without any regard to the working cycle or adequate testing to determine any special characteristics in the power requirements of their machines. Adequate tests should be conducted on the completed machine to determine the horsepower required and to allow for a reasonable margin of safety. These tests and a study of the design of the machine will determine whether a special motor is needed to make the machine operate most efficiently.

Development Time

Too often the manufacturer is so anxious to get his product on the market that he does not allow sufficient time for testing to determine the mechanical characteristics of the machine or to develop a special motor if one is needed. In the end he finds that all his haste has been in vain because his machines fall down in the field and he is forced to take the time at some later date to develop the machine properly. In most cases it is fairly safe to assume that if the product has any field at all, that field will be just as valuable after the product has been given the proper tests.

Some makers of motor-driven products find that there are times when a customer desires slight changes in the machine for his purpose. An example of this is shown in the case of one manufacturer who has frequent calls for a shaft an inch longer on the motor used on his machine. In the plants using standardized production this can be obtained, of course, but it cannot be obtained with the ease with which the smaller motor manufacturer can supply it. In the plant of the smaller maker of motors, such a request simply means telling one man in the shop to make that shaft one inch longer for a certain number of motors. In some of the larger plants it may be impossible to obtain the desired longer shaft except by a special order and at a higher cost.

If the machines are to operate in dusty places, be subjected to acid fumes, moisture, etc., care should be taken that the tests of the motors show whether or not they will actually stand up under these conditions.

Protect Your Pension System *Against Future Financial* Failure

MANY industrial employee pension systems fail because of incorrect planning and improper financing at the start. What has been done by several large organizations to overcome these difficulties and the scope and purposes of pension systems are discussed

By J. J. BERLINER

WHAT do you plan to do with this employee after perhaps twenty or thirty years of faithful service; pension him or forget him?

ONE of the most complicated problems confronting industrial employers at present is that of the pension system. Few of the industrial pension plans in the United States today are so financed that they are likely to remain solvent without refinancing or modification.

In the case of many municipal and other public service pension plans, failure to count the cost carefully has resulted in bankruptcy of the pension systems, either actual or constructive. Indeed, it is hardly too much to say that the history of pension schemes has been a record of mistakes or failures. Even the elaborate Carnegie Foundation plan was forced to undergo a radical reorganization only a few years after it was started.

Before taking up the question how a pension system shall be established, it is imperative to consider whether it should be established at all. Until a satisfactory answer can be given to this question there is little occasion to discuss the question of method.

Among the more important motives which lead industrial employers to adopt pension systems are:

(a) A desire to provide for the old age of dependent, superannuated employees.

(b) A desire to reward employees who have rendered unusually long service.

(c) A desire to increase efficiency, first by the elimination of superannuated or incapacitated workers on a humane basis and, second, by stimulating the good will and effort of the active force.

(d) A desire to hold the worker on the job, thereby reducing labor turnover.

(e) A desire to exercise a disciplinary control over workers in respect to strikes and in other ways.

Pensions as a Reward for Service

IN some pension plans all of these motives are present; in others, only a portion. The broad objects of pension systems, as enumerated, will now be examined.

A large number, perhaps a large proportion, of industrial workers either cannot or do not make adequate provision for their old age. When such workers reach a stage of superannuation the employer is forced with the alternative of throwing them back on society, with the knowledge that they will become objects of charity, or of himself making some provision for their remaining years. This practical fact has been an important and probably the controlling consideration in the establishment of industrial pension systems of the day. From humanitarian motives, the employer is not content summarily to dismiss such superannuated workers after long years of service. Moreover, he often hesitates to do this, on the practical ground that such a policy may have an unfavorable reaction upon the larger body of employees still continuing in the service.

The conception of pensions as a reward for service takes no account of the necessities of the workers, but, ostensibly at least, pensions alike all, whether self-supporting or dependent, who have rendered a given length of service to the establishment or who have fulfilled certain prescribed conditions. Furthermore, it does not necessarily require continuance in service until the employee actually is superannuated. Under many plans an employee who commences work at an early age may retire on pension before he can really be termed old if he has served the required number of years.

Many Pension Systems Are Inadequate

AS a straight reward of service most pension systems are grossly inadequate. The percentage of workers who go on the pension roll usually is only a small fraction of the total force, or even of those remaining with a company for long periods. Often it is almost negligible. Moreover, such systems become highly inequitable as between individual workers. An employee who happens to have completed, say, twenty or twenty-five years of service may get a pension, which may be thousands of dollars, while another worker, perhaps more efficient and more faithful, but who has just failed of completing the required period of service, may get absolutely nothing. If long service is entitled to a reward, then it would seem that a system which pays a large benefit for, say, twenty-years' service, but pays nothing for nineteen years' service, is inherently defective.

A further objection often advanced against the "reward-of-service" idea, as actually operative in many pension

plans, is that it may put a premium on inefficiency by keeping men in service, the retirement of whom should be the primary purpose of a pension system. For example, a humane executive may be tempted to retain on his force a worker who needs only one or two more years of service to entitle him to a pension, even though the worker has become distinctly inefficient. Paradoxical as it may be, a pension system may thus defeat what is perhaps its most important aim. On the other hand, a heartless factory executive may dismiss an efficient man approaching the retirement age, in order to save the company the cost of maintaining him later on pension.

Still again, it has happened that where the cost of pensions was rapidly mounting, the terms of the plan itself have been changed, with the result that many workers have been deprived of the pension benefit to which they have been looking forward.

Pensions for Increasing Efficiency

PENSIONS for increasing efficiency are one of the primary motives which have led to the establishment of pension systems. A pension system, it is urged, tends to relieve the employer of any compunction which he may feel over the dismissal of a worker grown old in his service and now without means, and thus more readily enables him to increase the efficiency of his working force by weeding out those no longer able to perform their allotted tasks. The "drag" of such workers upon production is well known to all industrial executives. It is extremely wasteful to permit a superannuated worker to continue at a task where his inefficiency means a lower output not only for himself, but for all others associated with him in the operation. In some cases, notably in work of a "line" character, it is imperative that such a worker shall not be retained, at least in the particular position. Many establishments have endeavored to meet this difficulty by finding other tasks of a lighter or less exacting character, to which such older workers are assigned. But the opportunities of this sort often are far too few to take care of the increasing number of superannuated workers. The employer has, therefore, resorted to the expedient of a pension system in order to enable him to dismiss such workers without raising any question of injustice or of adverse reaction on the other employees.

Pensions as a means of increasing efficiency are also one of the primary motives which have led to the establishment of pension systems. In distinction from increasing efficiency through elimination of the superannuated, it is often claimed that pension systems increase the efficiency of the active force. As already pointed out, the very fact that superannuated workers are thus provided for may exert a favorable influence upon the active members of the force and increase their good will, and thus perhaps their efficiency as well. Again, to the extent that a pension system relieves the worker during the stress period of life of anxiety over his declining years, he is, it is urged, in better condition, mentally and physically, to perform his daily tasks.

That pension systems do not materially increase efficiency of the active force was the conclusion reached by the Bureau of The Merchant's Association of New York, based upon a study of private pension systems made in 1919. Analyzing the replies of fifty-nine employers with respect to the effect on efficiency, the report in question said:

"That failure to produce increased efficiency can be traced to the fact that, in general, pension systems appeal only to employees who have grown old in their present employment. These employees usually constitute a relatively unimportant part of the entire working force and their habits of inefficiency, like all other habits, have become more or less fixed.

"In any event, the effect of a pension system on the efficiency of the active force will depend largely upon the terms of the plan, partly upon its certainty from the viewpoint of the employee, partly upon the character of the employee, and very largely upon his age. That it will not be an important factor in the case of the younger workers is practically certain."

A hope that pension systems will reduce the enormous labor turnover so characteristic of modern industry has been one chief reason for their establishment. Yet on this point it is possible to say with assurance that such systems are disappointing. The testimony of nearly all employers who have introduced pension systems is that the effect upon labor turnover in the case of workers under middle age is small, and often negligible. For workers nearing the retirement age, the prospect of a pension apparently is a decided incentive to continuance in the service. But the very fact that workers have remained in a given establishment until such age is of itself evidence that they would be likely to continue if there were no pension system. There is the further practical consideration that the worker past middle age has sufficient inducement to continue merely because of the difficulty involved in finding a new position. The reluctance of industry to employ men over fifty years of age, or even somewhat under that age, is proverbial.

To summarize briefly the preceding discussion, it may be concluded that a private employer is under no compelling moral obligation to provide for the support of his superannuated employees in their old age. Nor can a pension system primarily be regarded as a method of rewarding faithful service, although this purpose may be present. It may further be concluded that the prospect of reducing labor turnover, or of exercising disciplinary control over workers, does not promise results of sufficient importance to warrant the expense of a pension system, while the latter purpose is in many respects inherently objectionable.

It follows, therefore, that the one controlling justification of a pension system from the employer's standpoint is that it will increase efficiency, primarily through elimination of superannuated and incapacitated workers, and possibly by building up a larger amount of goodwill and interest among the active force. Although some of the other purposes discussed are important, they are incidental to the primary object of increasing efficiency.

A Sound Retirement System Is Essential

WHILE in many cases it is doubtful whether such efficiency is attained, this failure may be due to imperfections in the plan or to errors in administration. A sound retirement system should facilitate the problem of dismissing superannuated and dependent workers. There may also be some increase in the efficiency of the active force, but the evidence on this point is by no means convincing. To the extent that a pension system does actually increase efficiency it merits most careful consideration.

Increase in efficiency, however, is not in itself a complete justification of a pension system. Not only must a pension system be effective, but it must be inherently sound and equitable, and must not produce consequences injurious to the worker or to society as a whole.

The reasons why industrial pension plans in many instances have not worked out successfully in practice is that executives responsible for their construction have not taken into consideration the fact that the number of employees qualifying for pensions during the first years the plans are put into effect is referable to conditions existing at the beginning of the qualification period, say 25 or 30 years previously. The number of pensioners so qualifying is not indicative of the great payroll expansion that has taken place in the meantime.

Initiators of pension plans have frequently overlooked these facts, i. e., that an increasing number of future pen-

sioners were added to the list of employees each year, so that maturities will show a considerable annual increase, and that, if pensions are based upon a percentage of the salaries paid over specified periods, the amount of annual wage has almost invariably increased. The weakness, then, of most industrial pension plans is the neglect to analyze the circumstances thoroughly and to provide for the maturities of additional groups of employees each year. A curve drawn on a chart descriptive of the increase in the amount of pension payments would show sharp elevation after the first few years. This rate of increase is so marked that the management begins to realize that something is radically wrong with their pension policy. A brief study reveals that a continuance on the basis as adopted will become practically impossible. Therefore, the plan must be discarded or revised.

How One Large Pension System Operates

THE General Electric Company established a pension plan for its employees in 1912. The rate at which such pensions were computed was one per cent of the earnings for each year of continuous service. This was increased to 1½ per cent in 1918.

The company had $4,260,486 set aside as a reserve to meet obligations to employees reaching pensionable age December 31, 1926, and found it necessary to make several revisions in its pension plan in July 1, 1928. It was found necessary to increase the reserve of $4,260,486 set aside at the end of 1926 to $5,000,000. In addition, a pension trust was created providing for the investment of the money in suitable securities from time to time, and to use it for the purpose of providing the funds for those retiring on pension.

The retirement age in the past, after at least 20 years of continuous service, was 70 years of age for men and 60 years of age for women. Under the revised plan, employees at 65 years of age with at least 20 years of continuous service will be retired on pension at a rate expectancy basis at their request, or may be retired by the pension board subject to the following provisions:

The company supplements the pension plan by establishing an additional pension plan from contributions by the employees so that on retirement the provision for old age shall be more adequate. The funds set aside by the employees are and always remain theirs. If the employee leaves the company or dies, he or his estate receives the amount so accumulated in addition to the pension from the company.

The accompanying table shows how the additional pension plan works out. It shows just what each employee is entitled to, taking into consideration the different rates of pay and length of service:

Amount Accumulated at End of Period of Savings*

A Earnings per week	B Approx. amount set aside semi-annually	C 10 yrs.	D 20 yrs.	E 30 yrs.
$20	$7.50	$191.59	$505.52	$1,019.94
30	11.25	287.38	758.28	1,529.91
40	15.00	383.18	1,011.05	2,039.88
50	18.75	478.97	1,263.81	2,549.85
60	22.50	574.76	1,516.57	3,059.82
70	26.25	670.56	1,769.33	3,569.79
80	30.00	766.35	2,022.09	4,079.76

Monthly Pension

F 40 yrs.	G 50 yrs.	H From amount accumulated col. F**	I From company***	J Total
$1,862.87	$3,244.12	$19.76	$39.80	$59.56
2,794.31	4,866.18	29.64	59.71	89.35
3,725.75	6,488.24	39.52	79.61	119.13
4,657.18	8,110.29	49.40	99.51	148.91
5,588.62	9,732.35	59.28	119.41	178.69
6,520.05	11,354.41	69.16	139.31	208.47
7,451.49	12,976.47	79.04	159.22	238.26

* *Computed on basis of return of 5% per year, compounded semi-annually.*
** *To be paid for 120 months.*
*** *To be paid for life, computed on basis of 41 years of service and on rate based on life expectancy (1½% at age of 70).*

Thus, for example, an employee entering the service at 24, and remaining until he is 65 years of age, with average earnings of $40 per week, will set aside $15 semi-annually. If he leaves or dies at the end of 20 years of payments, the amount so set aside will be $600, but he or his family will receive $1,011.05. If he remains in the service of the company until 65 years of age, the amount so set aside in 40 years will be $1,200, but the amount accumulated will be $3,725.75. If he retires on pension at that time, the 120 months payments from the amounts accumulated would be $39.52, and the pension granted by the company for 41 years of service would be $79.61 per month, or a total of $119.13 per month. The above example is based on a return of five per cent compounded semi-annually.

Leeds & Northrup Company (Philadelphia), adopted a pension plan June 1, 1927, which differs radically from the one in use with the General Electric Company.

Under this pension system, retirement benefits are derived from the following two sources:

(a) The Leeds & Northrup Company purchases Service Annuities from an insurance company (Metropolitan Life Insurance Co.).

(b) Income Annuity which is secured by the employee's own deposits.

The combined benefits under the Service Annuities and the Income Annuity make up the total retirement income. This is a cooperative plan.

Normal Retirement Age—The normal retirement age, or the time when benefits under this plan will normally be payable, will be as follows:

(a) On the Service Annuities—Men, 70; women, 65.
(b) On the Income Annuity—Men, 65; women, 60.

The Company purchases for all of its employees who have been with the company five years or more an annuity, payable to 2 per cent of their earnings with the company to date.

For those who participate in the plan by purchasing income annuity, the company purchases each year for each employee who has been with the company for five years or more, an annuity equivalent to two per cent of the employee's earnings per year.

Annuities from Securities Pay Pensions

AS each employee ends his first five years of employment, the company purchases accrued annuities covering the previous five year's service, and from that time on continues to purchase annually for the employee service annuities at the rate of two per cent or one per cent of the employee's salary, depending upon whether the employee participates or does not participate.

Thus, if the company is able to carry out its intention indefinitely, those of its participating employees who attain the retirement age will receive a life income from the company's service annuity in the amount of two per cent of the total salary during employment. Total salary is to be interpreted for those paid on an hourly basis, as being based upon a normal week, not including any bonuses or overtime.

For example, if an individual's earnings at retirement age total $45,000, the total service annuity payable for life after the service annuity normal retirement age will be $45,000 times two per cent., or $900 a year, or $75 a month. The

(*Continued on page 202*)

Radio Research a Bridge to the Goal of Mass Production

The radio industry is forging ahead with a full realization that engineering is the most indispensable factor in the solution of its problems

By E. P. Edwards

Manager Radio Department, General Electric Company

WHILE the radio industry we know today started its rapid growth with the conclusion of the World War, its genesis considerably antedates this period. In the design of radio receiver and loud speaker combinations, for instance, we have been able through the medium of organized research to take advantage of the contributions of such workers as Hertz, Maxwell, Farraday, Heaviside, Helmholtz, Rayleigh and others. In order to better understand the character of the foundation upon which we are building, let us consider the more important, conscious engineering contributions to the radio art which have become available in this present century.

The first practical high frequency alternator was developed by Alexanderson in 1906; it was of the induction rotary disk type, having an output of two kilowatts at 100,000 to 200,000 cycles and marked the beginning of the end for those systems of transmission employing damped waves. At the time of this development we had the Fleming valve, or two-element tube, capable of detecting radio signals; the use of this tube marked the transition from detectors of the coherer, electrolytic and crystal types to the present three-element tube. Subsequently DeForest added a third element, the so-called "grid," which materially broadened the functions of the Fleming valve and provided not only a more sensitive detector, but also a tube capable of functioning as an amplifier and oscillator.

Problem of Transmitter Development

WITH the high frequency alternator at the transmitting end, and the three-element tube at the receiving end, there resulted a more dependable system of radio communication, employing Morse and similar codes, but as yet this system was not flexible enough to effectively and practically transmit speech. The coming of the power tube is an outstanding instance of the far reaching effect of pure science on an industrial development.

In a radio sense, there has been no more important problem than that of transmitter development. While there is little probability that transmitter design and manufacture will result in mass production, it is an outstanding fact that this development is the basic reason for mass production of receiving and reproducing equipment. Consequently, continuous scientific research and development must be employed if we are to hold the interest of the listener-in, and expand our field of endeavor. The invention of the tungsten filament and thoriated tungsten filament are outstanding contributions of research, and constitute an important step in our endeavor to secure minimum current consumption and better overall performance. These advances are of particular interest as they indicate the economic effect of research.

Facsimile telegraphy, television, radio beacons, carrier current communication are all special applications centering around the transmission of radio signals. In addition, there are "other purpose" applications of radio transmission such as telemetering, remote control and synchronization. These "by-products" of radio development may become important factors in our everyday life when their development is completed and their value realized. The so-called "by-products" are not limited to applications involving radio transmission. Even today devices and equipment resulting from radio research are utilized in the automatic selection and grading, by color, of cigars, pearl buttons, coffee and breakfast foods. Many other interesting applications, such as high frequency furnaces and automatic elevator leveling equipment, give promise of industrial expansion along lines that had not been thought of until present day radio made its appearance.

Guarding Against Valueless Research

THAT one little device as an outstanding example—the magnetic pick-up—this, coupled with a method for the electrical cutting of phonograph records and electrical reproducing equipment (all products of radio development), has rejuvenated the phonograph industry, which for a time appeared to have suffered a death blow as the result of radio competition; this competition, through the good offices of research, has been converted into an ally. Experience with a trained and highly organized research and developmental staff has demonstrated that it is extremely difficult, if not impossible, to avoid the tendency or temptation to desert a half-picked blackberry bush for the allurements and promise of one further along. These many invitations to depart from the paths leading to our main objectives, coupled with the fact that the personnel involved largely reflects the youth of the business, emphasizes the necessity for careful discrimination if we are to succeed in eliminating the chaff from the wheat, and avoid the dissipation of profits from real production through engineering expenditure on interesting, but relatively valueless applications.

On the other hand, we cannot afford to neglect a promising lead until some definite conclusion has been reached as to its potential value. In radio, rapid evolution results in obsolescence; marked seasonable demand; vigorous competition; patent complications and constantly changing requirements of the public as it acquires a radio education. Such fundamental conditions obviously complicate the problems of those engaged in the development, manufacture and sale of radio apparatus. Today in radio we have great variety, generally resulting in expense; coupled with quantity, quality production, presumably resulting in income, both factors demanding consideration as a function of time, which is the essence of up-to-date radio industry.

Statistical Methods in Engineering Problems

Engineering methods of calculating averages and errors of averages have not kept pace with the rapid developments in statistical theory

By W. A. SHEWHART, PH.D.*
Bell Telephone Laboratories, Inc.

HERE and there in the engineering literature of recent years we may find an occasional reference to the application of statistical methods to particular engineering problems. Furthermore the necessity for estimating the probable errors of experimentally determined results has been accepted in general by the engineering profession.

This note calls attention to some additional applications of modern mathematical statistical theory, to research, design, production, inspection, supply and other engineering problems. Attention is given to certain general types of problems in the solution of which statistical applications have been made, and to the nature of the possible economies effected thereby. It is reasonable to believe that very definite economic advantages can be obtained in any large industry through such applications.

In the application of statistics, as in the application of scientific laws in general, it is often very difficult to form even an approximate estimate of the magnitude of the resulting economic advantages and hence no effort will be made to give specific figures.

Some very important problems call for statistical solutions. One general type is the estimation of safety factors to allow for the happening of the unexpected. The failure of a piece of apparatus may involve, in addition to great financial loss, a serious injury or even death to one or more individuals. Telephone engineering illustrations could be mentioned but we shall consider a problem arising outside this field.

The civil engineer often must build levees or dams to take care of exceptional rainfall. Customarily he must make his estimate of the limiting flood height upon the basis of a few yearly records of the yearly run-off of the given area. Too low an estimate may result in a destructive flood. Of course this gives rise to a difficult problem in the solution of which modern statistical theory may prove to be a helpful tool.

Setting Engineering Standards

ANOTHER general problem is that of setting engineering standards, where, as is often the case, the underlying experimental data may show considerable dispersion. For example, the strength of a given kind of telephone pole is a function of its modulus of rupture. If we use standard methods and measure the modulus of rupture of each of a number of poles which appear to form a homogeneous group, we must expect to find even wide differences between the observed values because there are many factors influencing the modulus of rupture not easily discernible or at least not easily measurable and controllable. Indications are, however, that these causal factors approximate a constant system of chance causes, and hence that probability theory is applicable.

Assume that these differences in observed values of modulus of rupture for the different poles can be sufficiently well characterized by two parameters; viz., the average and the standard deviation. It is of great economic importance to obtain the best possible estimates of the expected values of these two factors as we shall now see.

If the average taken as standard happens to be in excess of the expected modulus, serious losses may be incurred through breaking of telephone poles under storm conditions; on the other hand, if the chosen standard happens to be below the expected value, losses estimated in hundreds of thousands of dollars are incurred through wholesale removal of telephone poles a number of years before such removal is actually necessary. Modern statistical methods assist an engineer in forming the best estimate of such standards in terms of the observed data, by making it possible for him to allow for sample size, to correct for error of measurement and to insure a homogeneous sample upon which to base his estimates.

Estimating Errors

THE results of research are almost always expressed in terms of averages and errors of averages, but engineering methods of calculating such errors have not kept pace with the rapid development in statistical theory. Particularly in cases of small numbers of measurements, errors calculated by the customary methods are much too small. In fact our best estimates may be 100 per cent or 200 per cent higher than those customarily used.

Even on general principles it goes without saying that, if it is worth while making an estimate of an error, it is worth while doing it to the best of our ability. Nothing short of the best estimates can satisfy the modern research engineer, particularly since these do not involve any additional labor. However, in certain classes of cases the economic importance of attaining the best estimate of an error can be easily illustrated. One such is the determination of the significance of observed differences in the measurements of the physical properties of two kinds of materials or in the qualities of operation of two experimental models of a given kind of apparatus. A specific instance would be that of comparing the electrical characteristics of two contact alloys, one the standard now in use and another a much cheaper material. In such instances we have two sets of experimental data corresponding to either the two kinds of material or the two kinds of model. We must determine if the observed differences between the two sets are reasonably attributable to chance. If they are and if we must select one or the other

* *This article is reprinted from a paper published in the Journal of the Franklin Institute.*

upon the basis of the available data without further experimentation, then we are free to choose the most economical material or design, even though the observed quality of the cheaper material is not quite up to standard.

Another application arises in building up any kind of apparatus out of a large number of piece-parts. To secure the economies of wholesale production, piece-parts are customarily manufactured in large quantities. It is a well-recognized fact, however, that the piece-parts of any particular kind are not identical one with the other and that the quality of operation of any assembled piece of apparatus is a function of the qualities of its piece-parts. To assure that a particular piece of apparatus will function within prescribed limits when it is built up of piece-parts selected at random, it is therefore necessary to control the probability distributions of each of the parts so that the resultant the chance fluctuation in a given part. Hence it insures an variations of the various piece-parts.

Estimating Degree of Dependence

MODERN statistical theory shows the cost of reducing the overall chance fluctuation by modifying the chance fluctuation in a given part. Hence it insures an economic distribution of effort in controlling the chance variations of the various piece-parts entering into the system.

Perhaps one of the most general and at the same time most difficult problems is to estimate the degree of dependence of a property of some material or of a piece of apparatus upon some one of its physical characteristics. For example it is known that the moisture content of telephone poles affects their modulus of rupture. Indeed a very definite relationship can be established between moisture content and modulus of rupture of small sawed pieces of timber. However, to determine such a relationship for poles is difficult because we cannot control all factors other than moisture content. The effects of these uncontrolled factors mask that of moisture content so that the degree of relationship between modulus of rupture and moisture content for telephone poles is a problem involving the theory of correlation. Examples of this character could be multiplied in all fields of engineering work.

Objects of Inspection

INSPECTION engineering has two objects: to protect the consumer and to effect economies in the method of production. To see how these two objects are attained it is of interest to consider briefly some of the details of the manufacturing problem. The telephone instrument, which is so familiar to everyone, is not so simple as it looks. To make it requires 201 parts and to connect it to another instrument requires approximately 110,000 more parts. The annual production of most of these parts runs into the millions, so that the total annual production of parts runs into the billions.

Twenty or more raw materials such as gold, platinum, silver, copper, tin, lead, wool, rubber and silk literally collected from the four corners of the earth, are used in the manufacturing process to produce this great quantity of piece-parts. The 100 per cent inspection given all telephone equipment at the time of installation attains the first object —the protection of the consumer. It is, as it were, the consumer's watch-dog. Modern applications of statistical theory to inspection, however, have to do with the second object, the economic phases of which can best be divided into five parts:

1—To determine, for each step in the process inspection, the economic percentage rejection or tolerance for defectives.

2—To reject defective material at such points in the chain of production as will make the net cost of rejection a minimum.

3—To determine for each step the minimum amount of inspection which will suffice to give economic control of quality. In other words, to introduce sampling inspection wherever possible.

4—To detect lack of control of quality or trends and erratic fluctuations.

5—To assist in finding the causes of these trends and to assist in their control wherever necessary.

Reducing Inspection Costs

THROUGH application of statistical theory, a very appreciable percentage reduction in the cost of inspection has been attained. The estimated annual savings to the Bell System accruing from carrying out the third object alone more than justifies all of the attention to such studies.

In production engineering where there are, in general, large quantities of data to be analyzed, even the choice of the method of analysis to be used may lead to appreciable savings through reduction of the number of observations required. A typical case is that where the estimate of the standard deviation may be obtained by either the root mean square or mean error method. Because of the greater efficiency of the root mean square method, fewer observations are required to obtain a certain degree of precision with this method than with the other one and annual savings effected in this manner may run into the thousands of dollars for a single kind of apparatus.

All Engineering Data a Sample

WE shall close with a supply problem. Telephone poles are supplied to the trade in a comparatively large number of classes to meet the various needs. To be specific, let N be the expected number of poles per acre, m be the number of sub-classes of poles defined in the specifications, $p_1'N$, $p_2'N$, . . . , $p_m'N$ the estimated expectancies of poles per sub-class per acre, p_1M, p_2M, . . . , p_mM the estimated expectancies of poles supplied to the trade per sub-class upon the basis of past experience, X_1 be the total expected cost of poles if $p_1'M$, $p_2'M$, . . . , $p_m'M$ of each class are used and let X_2 be the total cost if p_1M, p_2M, . . . , p_mM of each class are used, where M is the total number of poles used per year. Can we effect an appreciable annual saving by taking all possible steps to make $p_i' = p_i$ for $i = 1, 2, \ldots, m$?

Of course the two sets of estimated expectancies are subject to sampling errors and hence the observed differences between the two sets may or may not be attributable to chance. If they are, it would be useless to try to effect a savings in the way just indicated. On the other hand, if some test such as Chi Square indicates a significant difference between these two sets, then an attempt may be made to secure the economies accruing from making $p_i' = p_i$ for $i = 1, 2, \ldots, m$.

In one such study preliminary results indicate that an annual saving running into thousands of dollars may be made possible by securing a consumption of poles more nearly consistent with the expected frequency distribution into sub-classes as given by nature.

From a statistician's viewpoint, all engineering data may be considered as a sample. The engineer and man of business have for several years been making applications of statistical methods for representing these data. In fact it is this phase of the subject which up to the present time has received practically all the consideration in textbooks on the application of statistics to industry. It will be noted, however, that the problems raised in this paper are of a different nature and have to do with making use of data constituting past experience in guiding future engineering activities. All of these problems call for sampling theory and thus throw open an almost uncharted field of application. It is the interpretation of causal relationships underlying sampling theory that appeals to the engineer who himself believes, as did Thiele, that "Everything that exists and everything that happens is a consequence of a previous state of things."

Putting *Pep* into Sales Conventions

The electrical industry is probably one of the most progressive of business enterprises today as is evidenced by the things it has done to create interest in its annual sales conventions

By John Allen Murphy
Marketing Counsellor

A TRICK golf club, autographed by Bobby Jones, was offered as a prize in a golf tournament at the 1927 convention of the Shepard Electric Crane & Hoist Company. Undoubtedly the man who won this carried it home with great pleasure and will always remember the convention

THE electrical industry has an inferiority complex. We often hear electrical manufacturers apologize for the industry. They complain that the business is not so enterprising as it might be. They sometimes express a wish that they were in a better or a different business.

And yet, despite this wailing, the electrical industry is in many respects the most progressive of all businesses. For one thing it has worked out an original system of distribution that exactly fits its peculiar requirements. I know of no other trade that has solved this problem so well.

But probably the most individualistic thing that the electrical business has created is its sales conventions. Certainly no other field of commercial endeavor has originated so many unusual types of sales conventions. These conventions have for years been both the marvel and the envy of other trades.

For instance, as recently as July, the Edison Lamp Works pulled off a convention that has been the talk of the country ever since. It consisted of a mock trial. A convention of the company's Mazda distributors opened on July 30 in the usual convention fashion. Toward the end of the first day, E. E. Potter, assistant sales manager, got on his feet and said:

Jury Tries Sales Methods

"MR. CHAIRMAN, what I am going to say is perhaps a little out of order, but I have sat through today's meeting, and I think that you as chairman and the balance of us who have had something to do with its preparation are open to quite a little criticism. Our plans for handling this conference were to have it different from anything we had had before, and based on the premise that all those who attended would have a chance to air their views and ask a lot of questions. I don't think that we have fulfilled that obligation at all. I think this meeting is too typical of the usual meetings we hold here, and I think we ought to do something about it."

Mr. Potter suggested that instead of spending an entire week in talking about lamps and how to merchandise them, that the lamp business be put on trial. Accordingly, in place of the customary convention talks, the speakers were put on the witness stand. The delegates to the convention were asked to act as a jury. The chairman of the meeting, R. E. Harrington, was appointed both judge and prosecutting attorney. Department heads were put on the stand and asked to defend their work. Judge Harrington was primed with all sorts of questions and charges, covering points that the company wished to get over to its distributors.

Unusual Interest Aroused at Trial

THE trial was a whale of a success. It generated more enthusiasm among the attendants than any convention the Edison Lamp Works has ever held.

If we are to grant that sales conventions are necessary, and I don't think that their value is contested at this late day, the next matter to consider is how to run a convention so that those who attend it will receive a maximum of benefit from it. The trouble with too many sales conventions is that there is no way of telling whether the delegates are getting anything out of them. They sit throughout all the sessions without opening their mouths. They do not ask questions and without questions it is difficult to start those spirited discussions which are such a valuable feature of all meetings of this sort.

To make the persons attending a convention "sit up and take notice," it is necessary to dramatize the proceedings as much as possible. That is what the Edison Lamp Works did. That is what all companies do who originate successful sales conventions. Consciously or otherwise, they in-

troduce surprises or other elements into the meetings which keep the delegates interested throughout all the sessions.

When John Allen Corcoran was with the General Electric Company, he often sprung delightful surprises on his convention audiences. On one occasion Mr. Corcoran was scheduled to speak before a meeting of wholesalers on the subject of "BUGS." Beside the speaker on the stage was a large cabinet. As Mr. Corcoran took his opening applause, the cabinet was flooded with light and a large bug, measuring four feet by four feet, emerged from it. The bug looked like a cross between a toad and a caterpillar. Though it was painted in gorgeous colors, the huge insect was a picture of despair and hopelessness.

Bugs Pep Up the Convention

WHEN the audience had recovered from its astonishment, Mr. Corcoran said, "Gentlemen, allow me to introduce my friend the Man-Jo bug; Factor *Distribuarius. Habitat*: Contact between manufacturer and jobber.

"This bug feeds on indifference. Its presence is indicated by low turnover and a general decline in business health. Also lack of knowledge of the policies and practices of the jobber and manufacturer is another condition favorable to this bug. Sales conventions are a most effective means of exterminating such a bug."

The next insect introduced was Mr. Man-Jo-Sal. The speaker described him as Factor *Distribuarius Ageus. Habitat:* The contact between the manufacturer and the jobbers's salesman.

Going on, Mr. Corcoran said, "Carelessness is what the Man-Jo-Sal bug thrives on—carelessness on the part of the manufacturer in keeping the jobber's salesmen posted: carelessness of the latter in keeping themselves posted; and carelessness of the jobber in making it possible for his own salesmen and the manufacturer to keep in contact."

Among the other bugs sprung on the meeting were the De-Pub bug. *Habitat:* The contact between the dealer and the public; Jo-De bug. *Habitat:* The contact between jobber and dealer; Man-Pub bug. *Habitat:* Manufacturer and the public.

No two bugs were alike. All of them were grotesquely colored. Each of them was a laughable caricature on the trade situation he personified. An appropriate talk accompanied each presentation. The audience was kept in a constant uproar, but while the distributors were laughing they were unforgettably learning several valuable lessons.

One thing that distinguishes sales conventions in the electrical industry from similar meetings in other fields is that a large proportion of the electrical gatherings consist of distributors. The distributor in the electrical trade closely approximates the jobber or the wholesaler in other fields. In other industries, it is a rare thing for the manufacturer to be able to assemble a meeting of his wholesalers. It is done infrequently, but most manufacturers are unable to get close enough to their jobbers to make such assemblages possible.

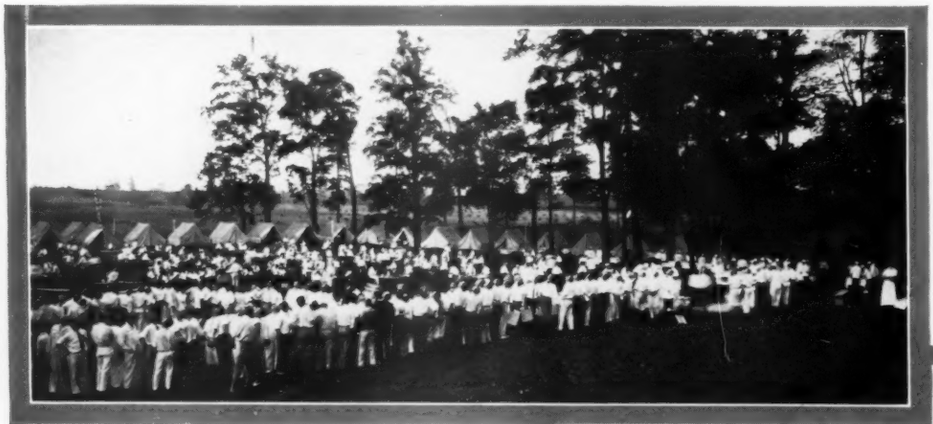
Of course, the factor in electrical trade channels called a "distributor" is not exactly a wholesaler. He carries only a few lines. Sometimes he represents only a single manufacturer. But the very fact that he does give such a large part of his time and effort to a manufacturer's goods, makes it obligatory for that manufacturer to keep him enthused about his line. The sales convention is the most practical way to generate enthusiasm.

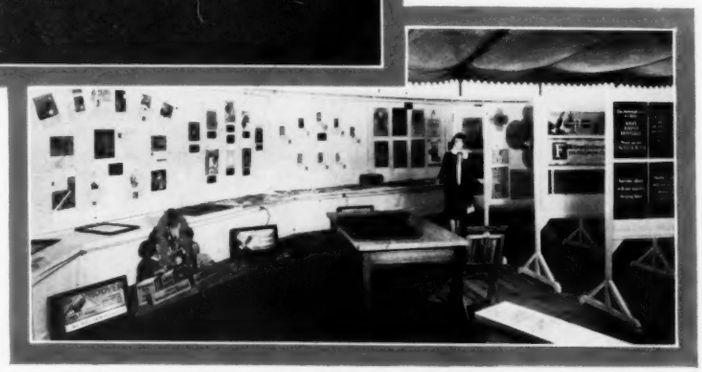
Atwater Kent Conventions

A TYPICAL distributors' convention is held annually by the Atwater Kent Manufacturing Company. Distributors and their wives are invited to attend the meeting. There is usually a three-day session, with strenuous morning and afternoon business sessions. The evenings are, as a rule, devoted to social affairs—dinners, suppers, theater parties, etc.

Vernon W. Collamore, the general sales manager, ordinarily presides over the business sessions. Of course, he addresses the distributors on the new sales program. The advertising agency takes a half day to outline the advertising plans for the coming year. Mr. Kent himself often talks about his product from the technical standpoint, explaining new models and improvements. Everything is done to keep the gatherings informal, so that every one present will feel free to take part in the discussion.

Many of the distributors bring their leading salesmen with them. The Atwater Kent Manufacturing Company's own salesmen and district managers also attend the convention. Thus, the gathering is not only a distributors' convention but also a convention of the company's own sales representatives. This is the favored method in the electrical industry and a wise practice it is, as there is no need to hold two conventions.





TWO views at The Hoover Company annual convention at North Canton, Ohio. In the background of the view above may be seen the tents that house the visitors and the line in the foreground shows the guests lined up at the outdoor kitchen for a meal, while the view at the right shows the manner in which The Hoover Company displays its advertising matter so that all concerned may be apprised of the company's efforts to increase sales

Newark Evening News Photo

This is a scene in the courtroom at a convention of the Edison Lamp Works of the General Electric Company during a trial of the sales methods and policies of the company. The judge is R. E. Harrington of the publicity department and the prosecution is being conducted by D. J. Finn of the Atlanta Office. No doubt such a procedure created unusual interest

The Atwater Kent Manufacturing Company does not hold its conventions in the same place every year. One year it was in Philadelphia. Last year it was in Atlantic City. This year it was in Chicago. Most companies hold their conventions always at the home office. In recent years, though, a vogue has grown up to hold sales conventions at isolated resort hotels, where there can be no interruptions and where the men can give their undivided attention to the program.

One of the greatest benefits derived from distributors conventions, is a by-product of the official program. The men get acquainted with one another. They impart enthusiasm to one another. They swap experiences. They tell how they solve typical problems. The younger and more inexperienced distributors learn much from the older men. On the other hand, the veterans regain much of their lost zest as a result of their association with youth.

Planning a Large Convention

THE Delco-Light Company and Frigidaire Corporation have held many notable conventions. Last year these organizations conducted a sales get-together which 2700 dealers attended and which set the company back $220,000 for actual expenses. The physical task of holding a convention of this size is enormous. Every detail must be planned months ahead with all the precision of a military campaign, even to preparing written instructions for each attendant. These instructions outline the entire program for the delegate, telling him what he is to do each day, where he is to eat each meal and where he is to sleep. This preliminary planning brought the total cost of the convention up to a half million dollars.

One of the many dramatic events of this sensational convention followed President E. G. Biechler's opening address. Full sized bushel baskets were passed among the delegates. Into these were dumped the orders which the dealers had brought with them. More than a dozen bushels of orders were thus gathered, totaling $3,500,000 worth of goods.

On other occasions, the Delco-Light Company has presented its story to its sales conventions in the form of a play, in which realistic scenery and regular actors were used. In fact this is a stunt that is often employed at conventions. It is felt that salesmen will get a message quicker and remember it longer if it is put over in a theatrical performance. Specially prepared motion pictures were also used in this way.

Sales Meeting in Mammoth Cave

AT another time, a sales division convention of the Delco-Light Company was held in Mammoth Cave in Kentucky. A regular program was pulled off in the most unusual environment of the cave—probably the first and last sales convention ever held in a cave.

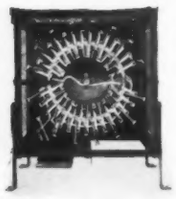
And, of course, every one in the electrical industry is familiar with the convention work done at Nela Park in Cleveland by the National Lamp Works. The National has been pioneering in convention innovations for as many years as your memory may care to run back.

District sales conventions are becoming popular in the electrical industry as well as in other trades. The Victor Talking Machine Company, for example, will assemble all its dealers in a district and show them its new models. It recently entertained 500 dealers from four states in New York City in this way.

Another type of sales convention that is becoming fairly common is the assembly of sales executives. Only a large concern that has a number of executives located all over the country would find it practical to hold meetings of this sort. The Graybar Company conducted a conference of this kind a few weeks ago. The merchandise and sales managers of its various branches assembled for a week to discuss the company's new selling policy.

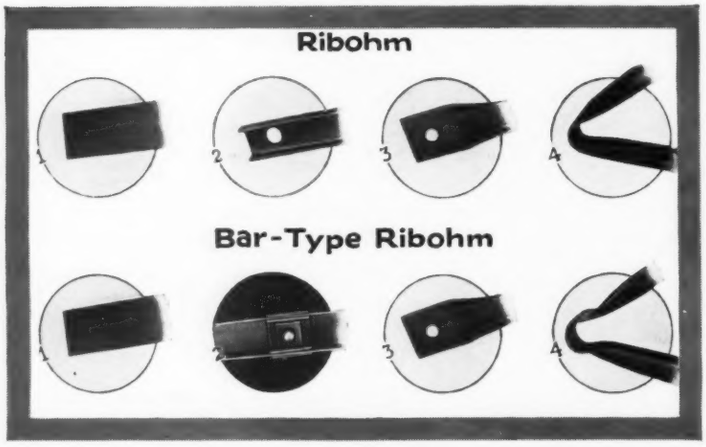
But it is to the Hoover Company that we must give the palm for holding the most spectacular sales conventions in the electrical industry. I described the elaborate Frigidaire sales convention, which was held in 1927. The Hoover

(*Continued on page* 201)



Ribohm

1. A metal ribbon of appropriate size and alloy
2. Is punched and formed into a "U" shaped channel and
3. After flattening at the ends and center
4. Is bent into a "V" shape, forming a complete resistive element, several of which make up the complete rheostat illustrated above.



Bar-Type Ribohm

1. A metal ribbon of appropriate size and alloy
2. Is punched and formed into a "U" shaped channel with provision for mounting and extra terminals and,
3. After flattening at the ends,
4. Is formed with specially shaped bends into a continuous resistive element, as illustrated above.

Standard and Bar-Type Ribohm Resistors

If you manufacture electrical control equipment employing large current capacity resistors and rheostats, Ribohm should be considered.

Ribohm is a patented resistive element made only by the Ward Leonard Electric Co. It was developed to take the place of bulky or heavy, or fragile resistors, such as cast iron grids, in heavy duty circuits.

Seven years of actual service in the field have proved the superiority of Ribohm Resistors in a great many applications now using resistors of other types. The advantages and limitations of Ribohm are known to us. Your engineering department will find ours ready to cooperate in determining the best application of Ribohm to your apparatus.

* * *

Ribohm Resistors are made in two forms which are identical electrically: (1) Standard Ribohm consists of individual "V" shaped resistors which are mounted in groups upon a suitable panel or base. This

Electric Control Equipment
WARD LEONARD ELECTRIC CO.
Mount Vernon New York

assembly frequently eliminates all internal wiring back of the panel. (2) Bar-Type Ribohm is a continuous element from terminal to terminal, except where tapered resistance is required. The continuous element eliminates entirely, all contact resistance.

Both types of Ribohm are made of a special metal ribbon of appropriate size and alloy, formed into a "U" channel for structural strength, and then bent into the proper shape for mounting. The cross section of the formed element is uniform, thus eliminating "current crowding" and consequent non-uniform heating. The channel shape, and special form of the bends, gives an element which is light, rigid, strong, and entirely self-supporting, even under exacting operating conditions.

The method of mounting and shape of the bends permits expansion and contraction without stress to either the resistive element or mechanical support. The little mass and great structural strength of Ribohm makes it the ideal unit for use where excessive vibration exists.

Unlike cast grids and other types of resistors, Ribohm resists corrosive action by moisture and atmospheric gases.

Weight for weight, Ribohm will dissipate more energy continuously than any other resistor of the same rating, and will occupy less volume in meeting this condition.

The weight of a Ribohm element is approximately 10% of a cast grid of the same rating. The complete Ribohm assembly weighs from 25% to 33% of an equivalent cast grid assembly. It is lighter than ANY other resistor of the same rating.

You will find Ward Leonard ready to work with you on the application of Ribohm to your control. Ask for a representative to call, or we shall gladly send you Bulletins on the subject.

Applying Insulating Materials to Coils and Windings

No. 6 of a Series of Insulating Varnishes and Impregnating Compounds

Asbestos plays an important part in the insulation of coils and windings to enable them to withstand high temperatures and high voltage

By D. H. Braymer

Consulting Engineering Editor
Electrical Manufacturing

FOR ordinary service in electrical machines, bare copper wire with single cotton covering or double cotton covering and enameled copper wire with single cotton covering or double cotton covering is used. Windings made up of these wires are then insulated with insulating tape and varnished for mechanical and dielectric strength, as has been outlined in the articles in preceding issues of Electrical Manufacturing. In industrial applications of electrical apparatus there are numerous instances where a winding must resist excessive heat as well as being mechanically and dielectrically strong.

In this article the special insulations for wire used to protect against high temperatures will be classified for convenience in discussing them as follows: 1—Asbestos covering for wire, tape, sleeving and paper; 2—Gum treatment for wire.

In discussing the application of asbestos to wires it will be of interest to describe briefly the process of making asbestos insulation as outlined by the Rockbestos Products Corporation of New Haven, Conn. A fine quality of asbestos is first made into a roving which is applied to the wire. In selecting the asbestos to be used particular attention is given to elimination of impurities such as particles of iron or magnetite. The roving is made from the raw asbestos on a carding machine. Because of small tolerances in the production of small wires, careful supervision must be given to this operation since the closeness with which the roving runs to the proper weight depends on conditions of humidity. When the humidity is high as in summer months, the apparent weight of the roving is partially made up of moisture which when evaporated leaves a light roving. Tests must therefore be regularly made and the carding machine operator must adjust the machine so that the weight of the roving produced will be constant irrespective of the humidity conditions. This roving comes from the machines in what is called a "cheese" which is a spool with hollow center, about six inches in diameter and two inches thick. This "cheese" is mounted so that it rotates freely and the wire to be covered passes through its hollow center. The end of the roving then passes through a driven "eyepiece" which revolves about the wire describing an orbit of about two inches diameter, thus applying the roving to the wire spirally.

The wire with this asbestos covering then passes through a tank of insulating compound after which it passes through a set of burnishing or polishing dies. These bring it to the desired size and give the wire a smooth finish. Three factors determine the outside diameter of the completed wire: 1—Size of the roving used; 2—The speed with which the wire travels while the asbestos roving is being applied to it; 3—The adjustment of the burnishing dies.

Asbestos covered wire will withstand very high operating temperatures. Tests have been made during which the conductor was heated to the fusing point and the molten

A battery of machines in the plant of the Rockbestos Products Corporation at New Haven, Conn., applying asbestos insulation to light-weight wires

copper dripped through the insulation. Although the insulating compounds were volatilized, the insulation still remained and showed considerable mechanical and dielectric strength.

The temperature limits usually followed in the use of insulating materials, are those of the Standardization Rules

Table III—Permissible Temperatures and Temperature Rises for Insulating Materials

Class	Description of Material	Max. Temp. to which the Material May be Subjected	Max. Temp. Rise
A	Cotton, silk, paper and similar materials when so treated or impregnated as to increase the thermal limit, or when permanently immersed in oil; also enameled wire.....	105 deg. C.	65 deg. C.
B	Mica, asbestos and other materials capable of resisting high temperatures in which any class A material or binder is used for structural purposes only, and may be destroyed without impairing the insulating or mechanical qualities of the insulation	125 deg. C.	85 deg. C.
C	Fireproof and refractory materials, such as pure mica, porcelain, quartz, etc.	No limits specified	

In the table 105 deg. C. is equal to 221 deg. F; 65 deg. C. to 149 deg F; 125 deg. C. to 257 deg. F; 85 deg. C. to 185 deg. F. In the explanation preceding the table, reference is made to the term "ambient temperature of reference." The Institute defines this term as follows: "The ambient temperature is the temperature of the air or water which, coming into contact with the heated parts of a machine, carries off its heat. . . . The standard ambient temperature of reference, when the cooling medium is air, shall be 40 deg. C." The value of 40 deg. C. is equal to 104 deg. F.

of the American Institute of Electrical Engineers. The following is taken from the section on permissible temperature and temperature rises for insulating materials.

"Table III gives the highest temperatures and temperature rises to which various classes of insulating materials may be subjected, based on a standard ambient temperature of reference of 40 deg. C. (See note under Table III.)

"NOTE: The Institute recognizes the ability of manufacturers to employ class B insulation successfully at maximum temperatures of 150 deg. C., and even higher. However, since sufficient data covering experience over a period of years at such temperatures are at present unavailable, the Institute adopts 125 deg. C. as a conservative limit for this class of insulation and any increase above this figure should be the subject of special guarantee by the manufacturer."

Different Types of Asbestos Insulation

WELL known makes of asbestos insulation for wires are furnished under the trade names of Rockbestos in white, black and amber colors, and Salamander and Deltabeston.

The Rockbestos white is capable of standing extremely high temperatures, such as in a motor subjected to sudden overloads so that the current in the windings generates a certain amount of heat quickly, attacking the insulation from the inside. An elevator motor might be a typical example. This covering is not impervious to acids or moisture unless additional treatment is applied in the form of an insulating varnish.

Rockbestos black insulation is intended for machines that may be subjected to considerable moisture, acid fumes and the like. It can also be impregnated with insulating varnishes.

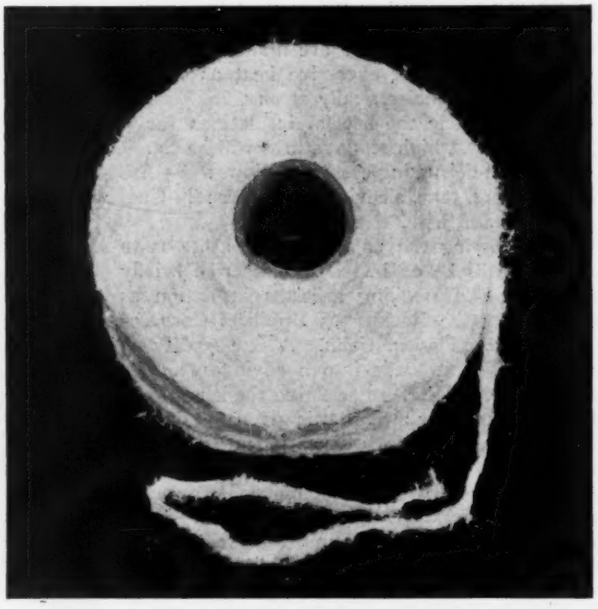
Rockbestos amber or type PN insulation is intended for use where windings are subjected to considerable abrasion and is provided with a very hard and tough finish. The principal ingredient in the finishing compound is a tough, elastic, air drying varnish. This insulation has all the good qualities of the white and black finishes and in addition has a higher mechanical strength. It is much used in repair work where machines are required to withstand overload conditions.

Salamander asbestos insulation is also made in white, black and amber finishes. The chief difference between the white and black is that the white will withstand higher temperatures and will absorb insulating varnishes better than the black finish. Salamander insulation is also furnished in a white enamel or WE finish which is amber colored and is used on magnet wires. Another Salamander insulation is the AV finish. A compound is used on the asbestos covering which when heated to a high temperature will slightly soften and adhere to the wires next to it so that the insulation and wires form a solid mass which will withstand considerable vibration.

Asbestos Tape and Sleeving Insulation

FOR use in field coils of machines, single cotton and double cotton coverings over the white asbestos insulation are usually used and the coils are impregnated with insulating varnish. The purpose of the cotton covering over the asbestos insulation is to provide mechanical strength and to protect the insulation against abrasion.

When using asbestos insulated wire in repair work it is important in order to provide the best possible heat resisting qualities to use heat resisting materials throughout the winding. That is to say, if a coil is made up of asbestos insulated wire, then asbestos tape should be used and the completed coil impregnated with liquid bakelite.



Asbestos "roving" ready for application to wire. Strange to say, this material is obtained from rock and is fashioned into strands for covering all kinds of wire for electrical purposes

In the form of tape, asbestos insulation can be obtained in widths from 0.5 to 1.5 in. and in thicknesses from 0.015 to 0.063 in. This insulation can be used on stator coils, rotor windings and field windings.

Asbestos sleeving for use over the lead ends of coils is made to certain wall thickness and inside diameter. The wall thickness will vary from 1/32 to 1/16-inch. Inside diameters for coil leads of ⅛ and ¼-inch are usually used. Asbestos sleeving is sold by the pound so that the number of yards in a pound is important when purchasing in quantity.

Asbestos paper is a combination of asbestos fiber and paper that is compressed but not sized. When used on coils for electrical machines it must be as free as possible from iron impurities. It also should have a low carbon content to stand high temperatures without carbonizing. In sheets or tape form, the tensile strength is low so that it cannot be used for the outside finish of armature or stator coils without additional protection. It may be used, however, as an outside finish for small magnet coils. It is mostly used between turns of strap-wound field coils and for this purpose should be 1/16 inch wider than the copper strap and not thinner than 0.007-inch. It is used in thicknesses from 0.015 to 0.020-inch.

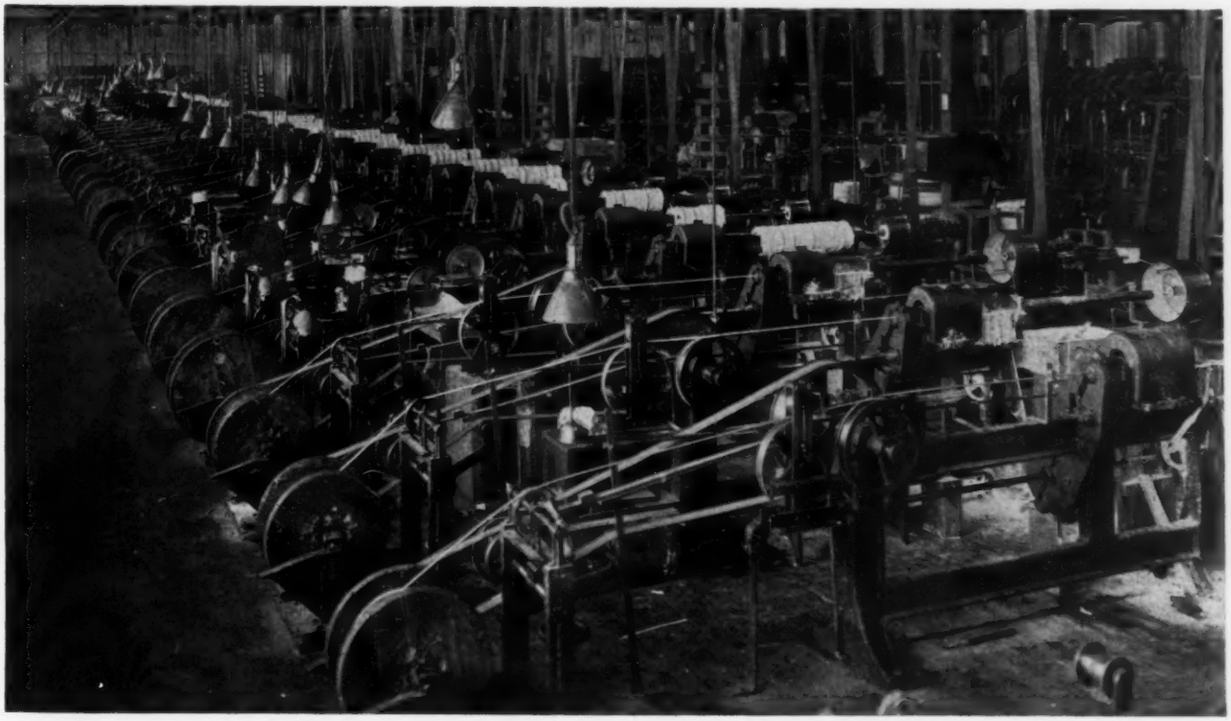
Various Types of Insulating Gum

WHEN asbestos paper or tape is stored for any length of time it will absorb considerable moisture so that whenever it is used on coils, and particularly between turns, the coils should be thoroughly dried before being dipped in insulating varnish and baked. Where bands are needed on coils, insulated for high temperature operation, asbestos string should be used. This can also be used for filling in the back of commutator necks on direct current armatures.

An insulating gum treatment has been applied to double cotton covered and triple cotton covered wire. The process used provides a covering which does not become hard or brittle but is slightly tacky with high dielectric strength. When wound into coils they may be used without dipping in insulating varnish before the application of tape insulation so that the final dip in the insulating varnish is all that is required. This applies particularly to low voltage work, voltages 110 to 500, and saves considerable time in connection with rush repair work. For the higher voltages a dip before the application of insulating tape in insulating varnish and the final dip provide the necessary insulation, for both mechanical and dielectric strength. Where the highest possible mechanical and dielectric strength is required triple cotton covered wire can be used with the gum treatment. This wire can be best used when coils are wound on a shuttle and pulled to shape. Excessive pounding when placing the coils in slots and the making of sharp bends are liable to injure the insulation and reduce the dielectric strength. This, however, is true of any insulated wire when it is desired that the dielectric strength be as high as possible in the completed job.

This is part of a coil from an arc lamp apparatus, which, because of excess current, became almost red hot, yet the asbestos insulation, while greatly overheated, continued to function properly

It should also be understood at all times that, no matter what the type of insulating material may be, or what the service of the insulated part is, too much care cannot be exercised in handling insulated parts to entirely eliminate insofar as is practicable any damage to the insulation.



Another view of a battery of machines in the plant of the Rockbestos Corporation at New Haven, Conn., showing the equipment used for applying asbestos insulation to heavy wire. In this equipment, the "rovings" or "cheese," as the rovings are often called, are held in a horizontal position, while they are held vertically when being applied to wires of lighter weights

*W*hat's NEMA *D*oing?

A department covering activities of the divisions, committees and sections of the National Electrical Manufacturers Association

F. R. Fishback Heads Nema Apparatus Division

F. R. FISHBACK, president of the Electric Controller & Manufacturing Company, Cleveland, Ohio, has been elected vice-president in charge of the Apparatus Division of the National Electrical Manufacturers Association, according to an announcement from Alfred E. Waller, managing director of the Association. Mr. Fishback was chosen to fill the office at a meeting of the executive committee of the board of governors. He replaces N. A. Wolcott, resigned.

F. R. Fishback

Mr. Fishback's business experience with the Electric Controller & Manufacturing Company has been extensive. He held the position of sales manager until 1924, when he was appointed vice-president. The following year he was elected president, which position he still holds.

As vice-president in charge of the Apparatus Division of Nema, Mr. Fishback represents a group which includes about 85 per cent of all the manufacturers of electrical apparatus and machinery in the country.

Nema Wire and Cable Section Enlarged at Rye Meeting

Forty wire and cable manufacturers were represented at a meeting of the wire and cable section of the National Electrical Manufacturers Association, at the Westchester-Biltmore Country Club, Rye, N. Y., September 19. With an attendance of more than fifty company executives, the meeting was perhaps the most thoroughly representative ever held in the wire and cable industry.

Election of officers and the addition of eight new wire and cable manufacturers to Nema membership were the outstanding results of the business program. As originally organized, the wire and cable section included only the rubber covered group. The scope of the section, which was greatly enlarged at the meeting, is now divided into the five working groups of bare and weatherproof, flexible cord, magnet wire, power cable and rubber covered wire.

Applications for membership in Nema, subject to the customary letter ballot, were received at the meeting from the following companies: Ansonia Electrical Company, Baltimore Copper Mills Division of the General Cable Corporation, Dudlo Manufacturing Company Division of the General Cable Corporation, Inland Wire and Cable Company, Providence Insulated Wire Company, American Brass Company, Maring Wire Corporation and Seward Wire Company.

H. Donn Keresey, general sales manager of the Anaconda Copper Mining Company, was elected permanent chairman of the enlarged wire and cable section. W. E. Sprackling, vice-president, Supply Division, Nema, and president of the Tubular Woven Fabric Company, was named vice-chairman of the section.

300 Nema Members to Attend Fall Meeting at Briarcliff

The assembly of 27 sections of the Apparatus, Appliance, Supply and Radio Divisions of the National Electrical Manufacturers Association will bring together more than 300 members at the fall meeting, to be held the week beginning Oct. 29 at Briarcliff Manor, N. Y.

Huntington B. Crouse, president, will make an address at the general session, Tuesday evening, Oct. 30. The Board of Governors meet the following morning. Following is the complete program for the week:

Monday, Oct. 29, 9:30 a.m.: Apparatus Division, switchboard group, mining and industrial locomotive (1st session), transformer (1st session), motor and generator (1st session); Appliance Division, heating appliance and motor fan; Supply Division, power cable section; Radio Division, vacuum tube section; 11:30 a.m., bare and weatherproof wire section; 2:00 p.m., magnet wire section; 8:30 p.m., air-circuit breaker section; Organization Committee with Committee on Section Specialists, 9:30 a.m.; Committee on Electrical Leagues, 11:00 a.m.; Section Chairmen, 8:30 p. m.

Tuesday, Oct. 30, 9:30 a.m.: Apparatus Division, oil circuit breaker group, motor and generator section (2nd session), transformer section (2nd session) and industrial control (1st session); Appliance Division, fan motor section (2nd session), electric range and water heating; Supply Division, rubber covered wire group and fuse section; Radio Division, power supply section; 11:00 a.m., transmitter section; Industry Relations Committee, 9:30 a.m., Membership Committee, Tariff Committee, 11:00 a.m., General Session, 8:15 p.m.

Wednesday, Oct. 31, 9:30 a.m.: Apparatus Division, switching equipment group, transformer section (3rd session), industrial control section (2nd session), welding section, electric measuring instrument section (1st session); Supply Division, carbon, lamp receptacle and socket sections, flexible cord group and electric porcelain section; 11.00 a.m., attachment plug section; 11:30 a.m., heater cord sub-group; Radio Division, transmitter section, 9:30 a.m., receiver section, 11:00 a.m.; Board of Governors, 9:30 a.m., dinner party, 7:30 p.m.

Thursday, Nov. 1, 9:30 a.m.: Apparatus Division, switch-gear section, motor and generator (3rd session) and electric measuring instrument (2nd session); Radio Division, transmitter section; 11:00 a.m., receiver section; Business Policies and Nominating Committees, 9:30 a.m.; Publicity Committee, 10:30 a.m.; rubber covered wire and receiver sections, 8:30 p.m.

Among the addresses scheduled for the general meeting are: "Nema's Position in the Industry," Huntington B. Crouse, president; "Adequate Tariff for Electrical Products," Thomas Allen of the MacAllen Company, Boston; "Radio Broadcasting and Television," Louis B. F. Raycroft, vice-president, Radio Division, Nema; "Terms of Payment," H. T. Bussman, president, Bussman Manufacturing Co., St. Louis. There will also be a talk by Francis E. Neagle, counsel for Nema.

E. H. Felix Joins Nema Staff as Special Radio Expert

Edgar H. Felix, technical writer, broadcasting and merchandising consultant, and author of "Using Radio in Sales Promotion," has joined the staff of the National Electrical Manufacturers Association to specialize in radio problems, according to an announcement by Alfred E. Waller, managing director.

Mr. Felix was for several years in charge of public relations of Station WEAF, and was subsequently associated with N. W. Ayer & Son, advertising agents.

During the past few years Mr. Felix has maintained an independent consulting business. He is a contributor to several radio and advertising publications.

Thermostatic Metal—Its Uses in the Electrical Industry

No. 7 of a Series of Articles on Common Materials

Accurate temperature control in electric devices has developed an extensive field for the use of thermostatic metals in the electrical industry

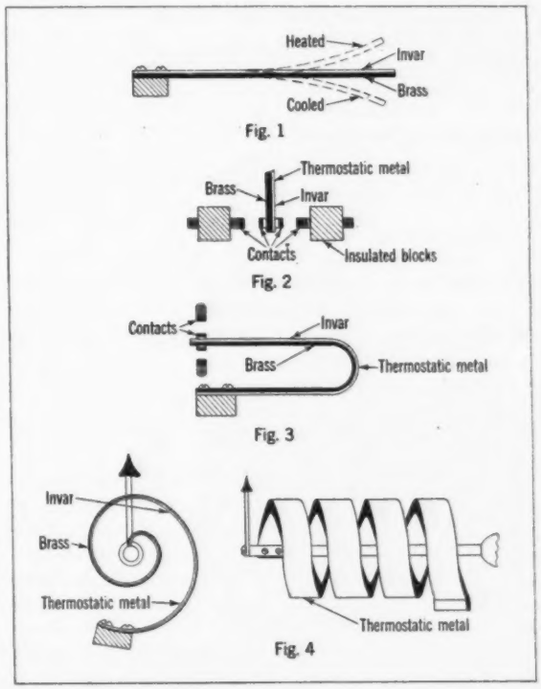
By William Crawford Hirsch

STEADILY broadening demand for electrically operated oil burners, refrigerators, and other domestic appliances in which temperature control is of paramount importance has resulted in a corresponding increase in the consumption of thermostatic metal as well as in the interest shown by electrical manufacturers in that product.

The principle has long been known that when two materials of widely different coefficients of expansion are joined by a bond and are subjected to a change in temperature a highly useful distortion is set up. In an earlier period of development, hard rubber and glass and other relatively crude combinations were used to produce this phenomenon of distortion.

Charles E. Guillaume, a Swiss metallurgist, and Louis Charles Dumas, a Frenchman, applied for a United States patent on Nov. 16, 1897, on a remarkable ferro-nickel alloy which later became known as invar. Their patent expired June 6, 1913. It covered "as an article of manufacture, an alloy of nickel and iron in the proportions of approximately 63 per cent of iron and 37 per cent of nickel, combined with another metal or alloy of known expansibility, whereby a product of predetermined expansibility is obtained." Invar metal or a ferro-nickel alloy, closely approximating it, serves as the low expansive member in thermostatic metal while brass contributes the necessary high coefficient of expansion. These two alloys have been found to give best service in producing the distortion that is put to work not only in the regulation of temperature controls, but also in auxiliary uses, such as circuit breakers and in tripping-mechanisms used in many heating devices.

Inasmuch as commercial thermostatic metal owes its efficiency in a large measure to the invar or invar type of ferro-nickel alloy, the characteristics of the latter deserve consideration. Guillaume and Dumas found that by varying the proportions of nickel and iron in alloys they could obtain products the coefficient of expansion of which varied within considerable limits. Using somewhat less than 20 per cent of nickel, they found the coefficient of expansion to lie between that of iron and that of nickel. When the proportion of nickel was raised until within 22 to 24 per cent of nickel, the coefficient of expansion closely approximated that of brass, when it attains its maximum. The coefficient of expansion was then found to diminish progressively with further increase of nickel to "practically nil" (according to the inventors) when the nickel content reaches about 37 per cent. Beyond this proportion the coefficient of expansion was found to again increase, becoming approximately equal to that of platinum when 45 per cent of nickel is used. The coefficient of expansion of ferro-nickel alloys thus varies between a maximum and a minimum, "being approximately zero," the minimum expansion being attained by alloying about 37 per cent of nickel with iron or steel.



In the above illustration Figure 1 is a straight strip of thermostatic metal, in one of its most common forms. Figure 2 illustrates its use as a circuit breaker, with a contact point on its free end and another mounted on the adjusting screw. Figure 3 is a similar application with the metal bent into a U shape, while Figure 4 shows a spiral or helical coil of thermostatic metal

Invar has come to be the designation for a range of alloys, based on the principles discovered by Guillaume and Dumas, rather than any one definite ferro-nickel alloy. These alloys are usually made either in the open-hearth or crucible furnace and to some extent in the electric furnace. Special heat treatment plays an important role in their production. Manufacturers of thermostatic metal refer in their sales literature to invar as having a coefficient of expansion of 4×10^{7} per deg. F. The mean coefficient of linear expansion between 0 and 40 deg. C. is of the order of one millionth for the ordinary invar, and samples have been prepared with even slighter negative coefficients. For many years foreign invar alloys had quite a hold on the American market, especially so-

called "Stoic" metal and kindred alloys of German, Swiss, and French manufacture. These have been virtually displaced by American made alloys which have earned a very high reputation for uniformity and efficiency. American metallurgists have made exhaustive studies of the heat-treatment most effectual for the invar type of ferro-nickel alloys, and the results of their studies have been embodied in the practice of American producers. The special treatment consists in its major phase of an annealing process extending over several weeks, carried out at successively decreasing temperatures. This aging is resorted to as a means of overcoming the after-effects following cooling from a high temperature.

Proper Functioning of Thermostatic Metals Depend Upon Their Uniformity

AS for the brass used in thermostatic metal to provide the reverse by way of dilatation from invar, the specifications of different manufacturers of thermostatic metal vary. According to one of the leading manufacturers, who gives the coefficient of expansion of the special brass he uses in his standard product as 9.8x10°, or approximately 25 times that of the invar metal at room temperature, a brass high in zinc content gives best results. Annealing also plays an important role in the manufacture of brass suitable for thermostatic metal.

In this connection it is interesting to point out that Guillaume and Dumas, in the application for the original invar patent, referred to a ferro-nickel alloy with a 22 to 24 per cent nickel content as having a coefficient of expansion "closely approximating that of brass," so that a thermostatic metal, made up of two ferro-nickel alloys widely varying in dilatation, may have been in their minds. Undoubtedly the technical experience gained in the last quarter of a century has given invar with brass the dominant position as thermostatic metal alloys.

This is in a large measure due to the degree of perfection which manufacturers have attained in bonding these alloys. Obviously proper functioning of temperature control and the life of thermostatic metal depend upon the solidity and uniformity of the juncture of the two alloys. According to the sales literature of one manufacturer of thermostatic metal "the two component parts, the invar and special brass are welded toegther by a special process, developed after years of experiment; no solder or brazing material of any kind is used in making this union, and the finished product may be stripped, bent, punched or heated to any temperature below that of the melting point of one of the two component alloys without causing a parting, cracking or slipping of the joint." In this way uniformity of temper and thickness are assured. "In the process we use," writes another manufacturer, "two blocks of different alloys are welded together by a secret process, and the mass then rolled to any desired thickness from 1 in. to as thin as 0.003 in." Certain it is that proper joining of the two alloys is the vital part of thermostatic metal manufacture, and that the specialists in that field have made great forward strides in attaining perfection in that direction.

Commercially, thermostatic metal may be divided into two classes: standard and special. Reliable manufacturers of standard thermostatic metal take special pains to warn consumers not to subject their product to overstrain. They caution against using standard metal at such high temperatures that permanent set, instead of only temporary distortion, will result. Bending the metal too forcibly at a constant temperature or heating it to an injuriously high temperature will result in a permanent set and internal strains. Ordinarily, so one of the leading manufacturers suggests, the standard grade of thermostatic metal should not be called upon to endure temperatures higher than 300 deg. F. There are special thermostatic metals that will stand up under much higher temperatures. One manufacturer reports producing a metal "with an expansion curve up to 1500 deg. F. that can be heated to as high as 1500 deg. F. without losing its elasticity."

When thermostatic metal has to be formed into shapes other than straight, internal strains are set up in the bending. To counteract these, artificial aging is resorted to, the formed metal being heated in an oven for a few hours or, better still, by subjecting it to a steam bath to a heat of 212 deg. F. for 24 hours. Where more thorough aging is called for, manufacturers recommend intermittent heating at 212 deg. F., alternating 12 hours of this treatment with 12 hours of room temperature for three days. Strains set up in forming, unless removed by heat treatment, cause the metal to slowly creep back to its original shape, thus vitiating the calibration of the instrument in which it is used. When thermostatic metal is exposed to the corroding influences of acids or gases, manufacturers recommend a protective coating of some resistant metal by plating, a safeguard unnecessary under normal conditions of use.

Definite laws, of course, govern the deflection of thermostatic metal, based as this movement is on the phenomenon of expansion, the deflection being impelled by the temperature change. The variables of the dimensions of the metal used and the pull, which applied to the end of a heated piece of thermostatic metal, will bring it back to normal have been incorporated into accurate formulas that are available to consumers from the manufacturers of thermostatic metal.

Standard thermostatic metal is manufactured in widths of 6 in. and lengths of 36 in., thickness ranging from ¼ to .020 in., but there is virtually no limit to the thinness that can be furnished for special purposes.

Applications of the metal most commonly in use are in the form of straight strips, U-shapes, and coils. In electrical circuit breakers, straight strips are used, a contact point being mounted on the free end of the metal and another on an adjusting screw. Helical and spiral coil shapes result in a rotating motion, especially useful in instruments with a circular dial or an indicating pointer. Manufacturers of thermostatic metal warn against the use of reverse curves or S-shapes.

Thermostatic Metals Have an Extensive Use in the Electrical Industry

THERMOSTATIC metal finds wide use in thermostats for heating appliances, such as flat irons, percolators, hot-plates, chafing dishes, heating pads, etc. Manufacturers of thermostatic metal list among other electrical uses: transformer thermometers, oven thermometers, thermostats for electroplating baths, thermostatically operated time switches, sign flashers, thermostats for electric heaters and ovens, and as compensation in electrical measuring instruments as well as for protection of ignition systems in gasoline motors.

As stated at the outset, the opportunities for a constantly broadening outlet for thermostatic metal in electrically operated refrigerators and oil burners is causing manufacturers to give special attention to these sales fields. Special high-duty grades of thermostatic metal have been evolved, and the research engineers of thermostatic metal manufacturers are working at high speed to develop additional grades that will function satisfactorily under high temperature conditions. One of the most impressive features in connection with the thermostatic metal industry is the fact that, whether it be standard or special metal, the producers and their engineers lay more stress on the limitations that cannot be ignored with impunity than upon the normal performance of their products.

In any event best results from the use of thermostatic metals are always obtained when the specifications and instructions of their manufacturers are strictly adhered to. This applies to classes of installations and to the varying degrees of temperatures to which the metals are to be subjected and are adapted for in their respective applications.

Electric Drive Releases Capital for Production

Under older systems considerable plant space was given to power production, thus decreasing the space and capital available for manufacturing

By R. H. Rogers

Industrial Engineering Department, General Electric Company

THE immediate physical effects following the adoption of electric drive; such as reduction of power requirements, elimination of shafting and belts, and the attainment of greater flexibility in the application of power; have been repeatedly and copiously brought to the attention of all concerned. There are several deeper and more far-reaching conditions and effects to the credit of electricity that have not received such generous attention.

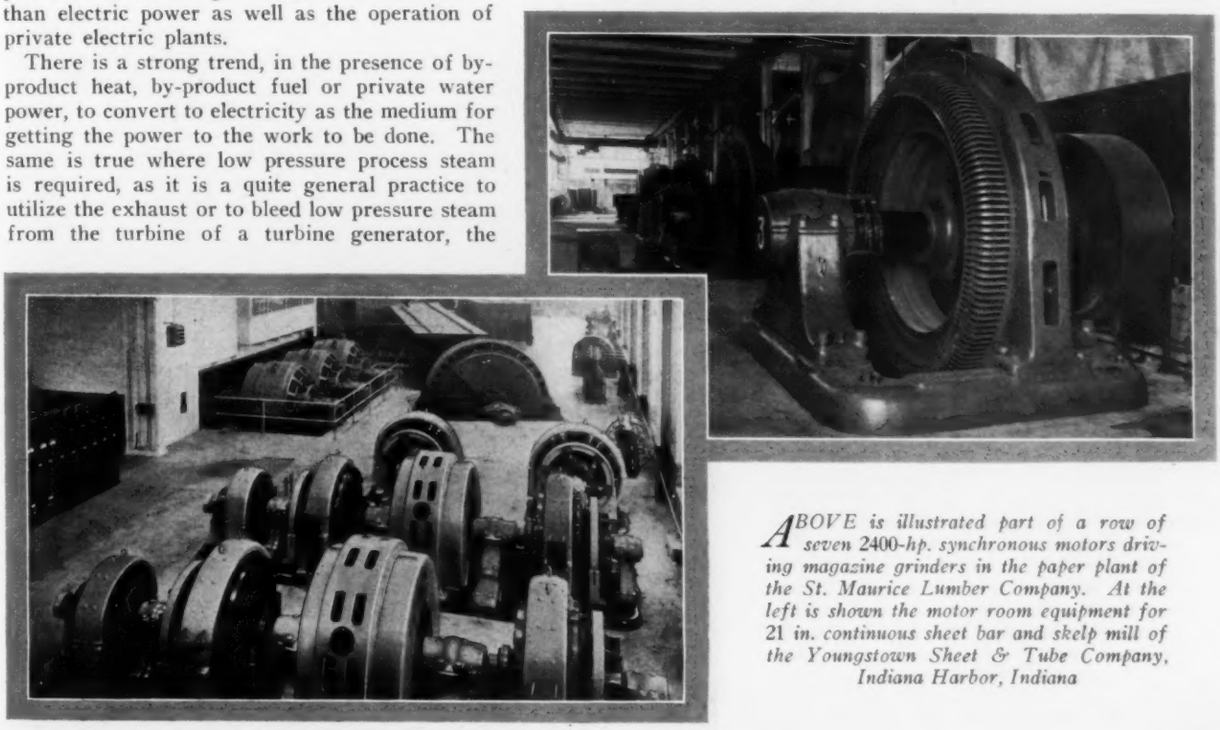
Between 65 and 70 per cent of all the power used in American industries is electric and the growth of this type of power is far greater than the total growth of power in industry. It is significant that the newer plants in an old established industry are the most nearly 100 per cent electrified and that the newer industries, such as the automotive activities, are, and have been from the first, practically 100 per cent electrified.

Many industries are characterized by the presence of by-product heat or by-product fuel or by uses for process steam. These items, together with privately owned water power sites, will long continue the use of other than electric power as well as the operation of private electric plants.

There is a strong trend, in the presence of by-product heat, by-product fuel or private water power, to convert to electricity as the medium for getting the power to the work to be done. The same is true where low pressure process steam is required, as it is a quite general practice to utilize the exhaust or to bleed low pressure steam from the turbine of a turbine generator, the electrical output of which is used to drive plant machinery.

Having thus outlined the place of electricity in modern industry, some of its broader effects may be noted.

The first effect is the retirement of industrial plants to large industrial centers. Early operations were established at water power sites or in parcels along a stream to utilize several small water powers. Certain classes of work using great amounts of power on products of low unit value were for long considered feasible only with direct water wheel drive. The advent of electric power has changed all that. The small water power sites have passed out of the industrial picture. They are now combined into fewer heads and are driving hydroelectric stations tied in with steam stations to form great stable systems. The various enterprises are now fewer and larger. They are located in advantageous centers, and enjoy full power the year around. Many times it has happened that a half dozen or more industries along a stream have pooled their water power rights, rescued the power formerly lost between plants, or-



ABOVE is illustrated part of a row of seven 2400-hp. synchronous motors driving magazine grinders in the paper plant of the St. Maurice Lumber Company. At the left is shown the motor room equipment for 21 in. continuous sheet bar and skelp mill of the Youngstown Sheet & Tube Company, Indiana Harbor, Indiana

ganized a hydroelectric company, reclaim all the power required for their own use, and market an equal amount of surplus power. The tie-in with other systems has given stable power and the old power limit to their expansion has been removed, so that they are free to grow how and where they please without having to consider getting power from the old water-wheel shaft to their manufacturing processes.

The second consideration regards the change in conditions for the personnel of industry. The little bleak, monotonous mill town is passing, men and women find their employment in large towns and cities where they can live broader lives. Their churches, theaters, contacts with people otherwise employed, and the conveniences and facilities at hand make for contentment and a negligible labor turnover.

Space and Capital Released

FROM another standpoint, electric power has revolutionized processes and made possible great concentration of power under the control of few workers. The President of the American Federation of Labor has said that electric power, with all that it entails, is the greatest single factor in the shortening of working hours for American industrial employees.

A third angle from which we might view this general subject is that of the release of space and capital for application to production. Under the older systems a considerable portion of plant space was given to the production of power, either in a centralized power house or more often in a number of scattered boiler and engine rooms, or water wheel housings. Purchased power particularly has made it possible to utilize practically every foot of plant for production, to say nothing of the bettered conditions for production which have been thoroughly covered in numerous publications.

Capital investments, overhead, and operation costs, are heavy items chargeable to power plant equipments and worst of all, they are usually administered by those whose prime interests are in the manufacture of some product other than power. Purchased power has, therefore, made available for direct application to production millions of dollars that would otherwise be tied up in the more or less inefficient production and distribution of power.

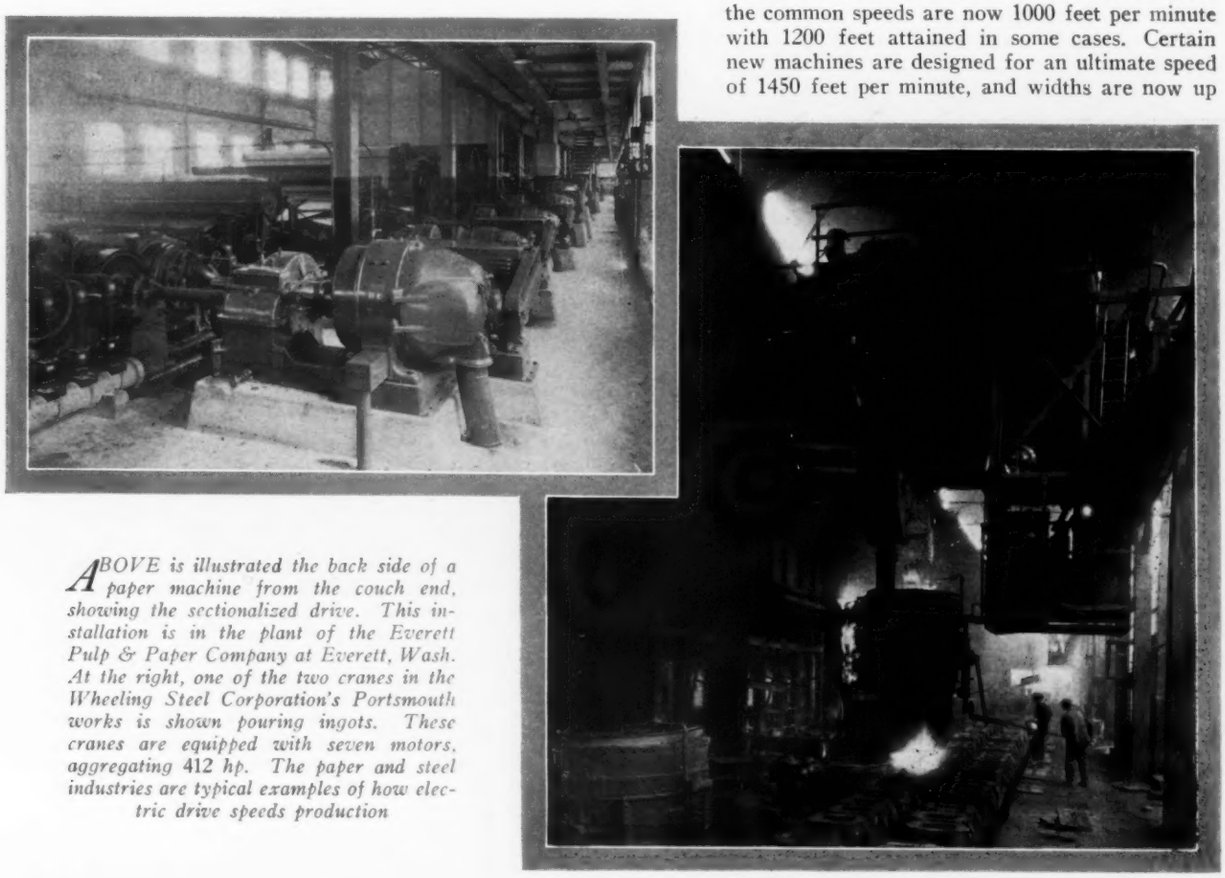
Conservation of our natural resources, our fourth effect, is not the least valuable of the functions of electricity. It has made available vast water powers with consequent direct saving of coal and it has, by concentrating steam power production into gigantic stations, reduced the coal requirement per horsepower as much as fourfold. Furthermore, it has made available for power purposes much of that wealth of by-product heat and by-product fuel that has in past years entirely gone to waste.

For the fifth subdivision of the subject we may consider the high rate of production that now prevails through the agency of electric power.

Speeding Production

THE ways in which production has been speeded up are so numerous and divergent that we can only dwell upon a few of the outstanding instances. The manufacture of paper is a good example, because electric drive has pushed up production rates in all branches of the industry. Water wheel driven pocket type grinders for making wood pulp have given way to motor-driven magazine type grinders. utilizing motors of 2800 horsepower. They are most economically arranged, and ton for ton require only one-seventh the labor formerly needed, and the work is carried out on one-tenth the ground space.

The paper machines were limited by mechanical drive to speeds of 500 or 600 feet per minute, and in widths to less than 200 inches. With individual electric drive the common speeds are now 1000 feet per minute with 1200 feet attained in some cases. Certain new machines are designed for an ultimate speed of 1450 feet per minute, and widths are now up



ABOVE is illustrated the back side of a paper machine from the couch end, showing the sectionalized drive. This installation is in the plant of the Everett Pulp & Paper Company at Everett, Wash. At the right, one of the two cranes in the Wheeling Steel Corporation's Portsmouth works is shown pouring ingots. These cranes are equipped with seven motors, aggregating 412 hp. The paper and steel industries are typical examples of how electric drive speeds production

to 270 inches, or for a trimmed sheet 22 feet wide made at a speed of over fifteen miles per hour. With all this speed, reliability has been bettered and sheets seven hundred miles between breaks have been produced, while maintenance costs of the drive have dropped to one-fourth of the figures that held for the older drives.

Woodworking in all its details has been speeded up. This effect is felt from logging and yarding clear through to the manufacture of the finest of wood products. Huge head saws tear through giant logs at unbelievable speeds under the urge of the relentless electric motor. At the other end of the scene tiny motors driving sanders, molders, tenoners and the like, run at speeds unattainable by mechanical arrangements of gears or belts. Some run as high as 30,000 revolutions a minute, with consequent rapid feeds and savings of rehandlings for grain directions, so that production is speeded up to keep pace with these electrical times.

Arc Welding in Manufacturing

AN abrupt change of thought brings us to the effects of welding by electric arc in manufacturing. The adoption for production purposes of this process, which only a short time ago was looked upon as a means for making repairs or as a "putting-on tool," has been so rapid and far-reaching that the general public and even those more intimately connected with the metal world are as yet unaware of its scope.

Arc welding for thousands of products does away with patterns, castings, together with casting losses, much of machining, and withal results in lighter, stronger and better construction. It reduces necessary stock of materials and parts, and greatly shortens the time from completion of design or receipt of order to the finished article. The electrical manufacturer has not been slow in taking liberal doses of his own medicine. Arc welding has made possible marked reductions in the space occupied, in the time required and in the developments and shop costs of many major products.

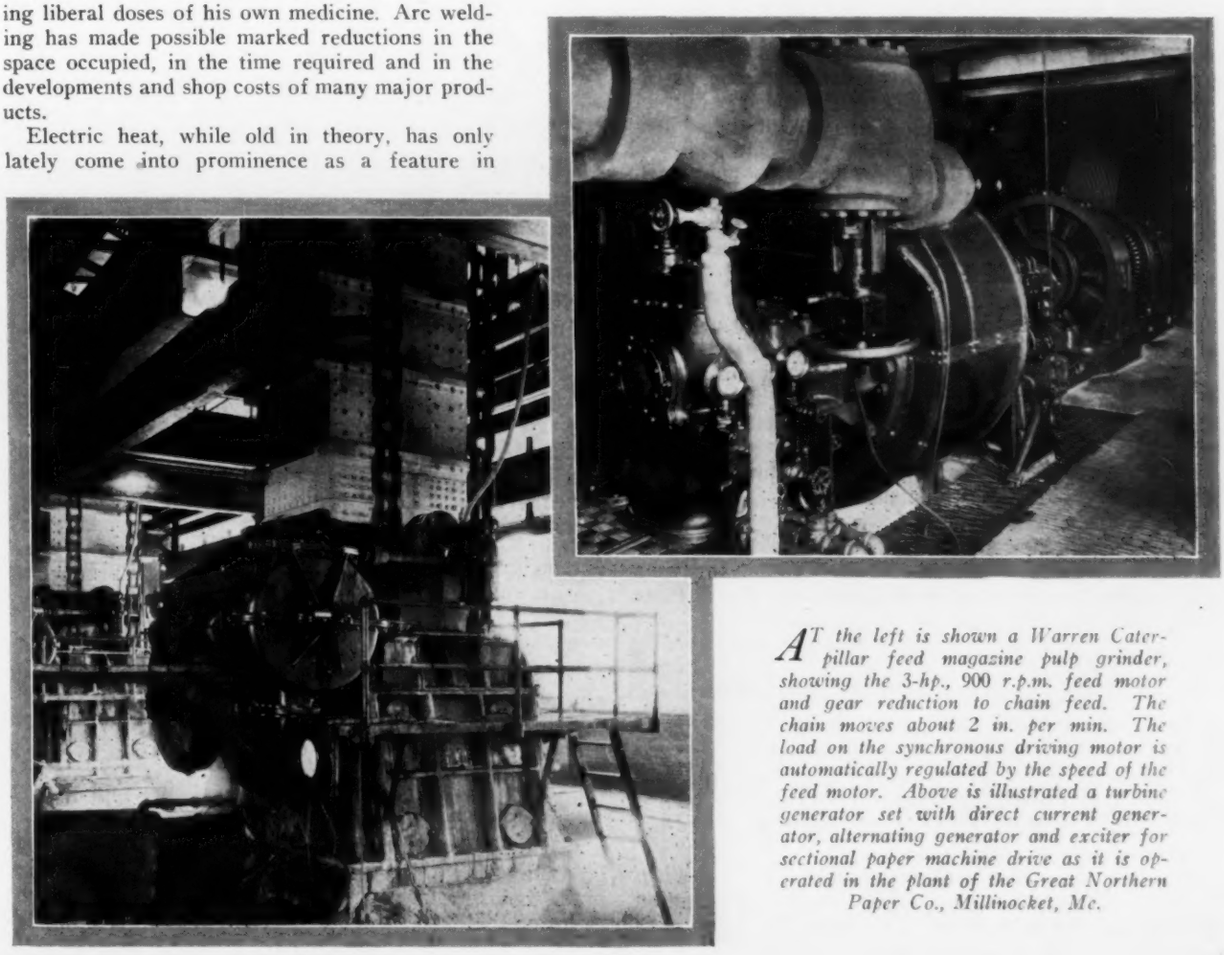
Electric heat, while old in theory, has only lately come into prominence as a feature in manufacturing. The growth of heating loads on central station systems is astounding, and it is freely predicted that its possibilities equal those of electric power. Wherever it is used, the result is a speeding up of the process coupled with better and more uniform results and a reduction in maintenance costs.

Electric Power Lowers Production Costs

THE sixth and last phase to be considered here is that of production costs. Costs are naturally reduced if power is delivered more cheaply at the place where the useful work is done. With the exception of the aluminum and ice industries, the cost of power runs from one-half to six cents per dollar's worth of product. A change of 25 per cent either way in power cost would therefore affect total costs but little. The summation of the less tangible advantages of electric drive is of far greater importance, and that is what has brought electric drive into leadership.

A summary of the effects of electric drive compared with older methods will serve to bring out more clearly the salient points:

1—Location and plant-plan freed from the old limitations as to source of power and its distribution.
2—Improved living conditions and a general uplift in personnel.
3—Release of capital and space for direct manufacturing.
4—Conservation of coal and oil by utilizing water power and by using fuel more effectively.
5—The speeding up of production makes more output possible per unit of space and per man-hour of labor.
6—Reduction of production costs results from various combinations of all the above, together with marked reductions in the cost of the power.



AT the left is shown a Warren Caterpillar feed magazine pulp grinder, showing the 3-hp., 900 r.p.m. feed motor and gear reduction to chain feed. The chain moves about 2 in. per min. The load on the synchronous driving motor is automatically regulated by the speed of the feed motor. Above is illustrated a turbine generator set with direct current generator, alternating generator and exciter for sectional paper machine drive as it is operated in the plant of the Great Northern Paper Co., Millinocket, Me.

Station G-A-G-E, Editor Speaking

Stanley A. Dennis, Editor and Assistant to the President

Prize Contests and the Postal Law

PRIZE contests, like the poor, are "always with us." Probably the editor of an electrical business paper realizes better than anyone else in the industry the number and variety of contests that are under way at any one time in the various sections of the country and in the different groups in the industry. The editor's desk is seldom free of contest material of one kind or another and almost every mail brings a letter telling why "*our* contest" is different and "should have special editorial treatment." An experienced editor handles these contests about as gingerly as he would a stick of dynamite. He knows that if the contest meets the disapproval of the Post Office Department the entire issue of his publication will be unmailable.

Once in a while these contests originate in one of the industry's associations but most of them are initiated in the advertising or sales departments of electrical manufacturing companies. Nearly all contests of this kind involve the use of the mails. Seldom, if ever, does the advertiser inform the editor whether the contest has been approved by the postal authorities. In absence of such information the editor submits the contest material to his local postmaster for a ruling. If it is an adverse decision, the editor, of course, can give no place to the contest in his publication.

A single paragraph in the Postal Laws and Regulations (Section 473) has wrecked the promotion plans of many an advertiser and has made trouble for countless editors caught off guard. It is true that the paragraph is difficult to understand and seems out of date. And it is true that it has been variously interpreted by lawyers and postal officials. Nevertheless it is the law. And while it stands, it would seem to be the part of wisdom for any advertiser who plans a contest to submit the details of that contest to his local postmaster before using the mails in connection with it. Certainly the advertiser or sales manager should obtain approval before spending money to promote the contest through the mails.

An excellent discussion of this whole subject appears in the October 4 issue of that dependable little publication, *Printers' Ink*. The editor of ELECTRICAL MANUFACTURING heartily commends it to the attention of all companies engaged in or contemplating prize contests which involve the use of the mails.

Considering the multiplicity of contests these days, one is tempted to wonder whether it would be a good idea to declare an "open" and a "closed" season for them. They might be more profitable in the long run if there were fewer of them, too.

Tighten This Loose Connection

CONSIDERING the annual investment which manufacturers make in advertising, one would expect that they would see to it that the men of their own organization are sold on that advertising. Yet frequently such is not the case. And the result is, of course, a certain loss on the investment.

Not long ago an electrical manufacturer's salesman was calling on a wholesaler and during the conversation the two men began to thumb over the pages of an electrical business paper. The wholesaler paused at an advertisement of an appliance, with his hand resting across the lower portion of the page. Suddenly the salesman launched into an emphatic objection to the design of the appliance advertised. One can imagine his speechless astonishment when the wholesaler removed his hand, revealing the fact that the salesman was "knocking" a new product of his own company. Of course, this is an extreme illustration, but other instances approaching it could also be cited.

It is pleasing, therefore, to find on the editor's desk a copy of an electrical manufacturer's house magazine (Aladdin Manufacturing Company), in which the advertising policies of the company are outlined in detail for the information of the company's salesmen. Business paper advertising and consumer paper advertising are discussed, and an explanation made of the company's point of view in each case. The salesman is told where the company advertises and why. And reasons are given showing why the manufacturer's salesman should coordinate his selling effort with the company's national and business paper advertising.

Too often this emphasis is lacking in the manufacturer's marketing plans. A loose connection in a sales organization may be as troublesome in the long run as a loose connection in an automobile or any other complicated piece of machinery.

Friction and High Speed Production

FRICTION created from the movement of metal surfaces in contact is an old problem which today is even more complex and vexing than ever before. With higher rotating speeds, continuous operating of machines at maximum loads, and carelessness in attention to adequate lubrication, this problem of friction is a source of ever-present trouble all along the line in any manufacturing plant.

In electric motors and at other points where interruption of service may cause expensive delays in the production schedule, ball and roller bearings and the alemite or other similar method of applying grease lubrication, are fast being accepted and installed as a means of reducing friction and improving operating conditions. But in all manufacturing plants there is yet a predominance of the sleeve bearing, ring oiled, using babbitt metal or bronze as the stationary surface supporting rotating shafts. Here friction means wear, noise and trouble besides a varying consumption of non-productive power about proportional to the effectiveness of the lubricant used.

All of the large oil producers are giving keen attention to this subject because of the market for their products and much valuable information is originating in the research departments that they maintain. In the October number of a house magazine of one of these producers appears an enlightening technical article on the lubrication of electrical industrial trucks, tractors and hoists. In part, the comment on the truck is as follows:

"For the electric truck to function at its best it must be equipped with a motor of high starting torque in order to insure maximum tractive effort or acceleration at lower speeds. In this connection it is interesting to

know that the torque will vary usually inversely with the speed. The fact that starting loads will frequently be high, necessitates most perfect conditions. Especially does this involve the matter of friction. Abnormal wear between bearings and armature journals will not only impose considerable load on the motor but will as well reduce its effective power developing capacity. Furthermore, bearing temperatures will be increased and such conditions unless corrected by proper lubrication will rapidly go from bad to worse, rendering the truck or hoist incapable of doing the work required. Ultimately, if neglected, it will require overhauling, perhaps rewinding of the motor, and very probably renewal of bearings."

Manufacturers of this and like equipment have an opportunity to show longer life of machines and lower maintenance costs by educating the user on the subject of lubrication best suited to their apparatus. This information should go with the machine in the form of instruction tags, dealing plainly and emphatically with the procedure to follow in the use and application of oil or grease. It is not safe these days to assume that a place for oil or grease is all that is required to insure their use and satisfactory service. The experience of the automobile manufacturers has demonstrated this and now the modern automobile is provided with a dashboard temperature gage and an oil separator and purifier to meet the speed conditions and protect the moving parts of the engine mechanism from carelessness and ignorance of the operator.

Pull Down the Fence

FOR some reason or other there seems to be prevalent in the electrical industry an idea that only the electric light and power companies have any obligation to cultivate better relations with the consumers of electrical products and electrical service. Everybody knows that the central stations are alive to this responsibility and, on the whole, are discharging it creditably. And thinking seems to mark time at that point.

Not often, however, does it seem to occur to the executives of the national associations of manufacturers and wholesalers and contractor-dealers that they also share such an obligation. Too often a trade association hides its constructive work from the public so effectively that the consumer has little or no conception of the work of the association in the interest of the public. Too often the association lives within a high fence that might better be pulled down. No wonder that the public does not have an adequate understanding of trade association work, and no wonder that it is often antagonistic to it.

The necessity for maintaining right relations with the public has been appreciated by the great corporations of the country, but too few of the trade association executives in various fields have awakened to their responsibility in this connection. This thought was well expressed recently by Dr. Hugh P. Baker, manager of the trade association department of the Chamber of Commerce of the United States. He said, in part:

"There are many ways by which a trade association executive can carry on activities that would not only sell his association to the members but also to that particular section of the public which the industry or association is trying to reach. It would seem at times that some associations have literally built a fence around their activities and feel themselves too busy to pay any attention to anything outside the fence or, in fact, to recognize that there is a world of importance to them beyond the fence which they have erected. There have been cases where the fence has fallen in and both manager and association have been crushed under it."

There are a number of associations within the electrical manufacturing field. They are engaged in work which ultimately affects the consumer. If the story of these association activities were interpreted to the public in a legitimate way and if the story were humanized effectively, the resulting benefit to the associations themselves would probably justify the admonition to pull down the fence and, in fact, make the associations wonder why they had ever erected fences at all.

Manufacturer and Architect

FOR a long time there has existed a very definite need for a better understanding between the electrical manufacturer and the architect, especially the man in the architect's office who writes the electrical specifications and who draws up the conditions or stipulations attending a given job. Frequently one hears the electrical contractor spoken of as the most important man between the manufacturer and the consumer, "the man on the firing line" or "the contact man of the industry," and yet in countless instances the success or failure of an electrical installation may rest on the shoulders of the architect or builder whose previous decisions decide what the contractor shall or shall not do long before he actually picks up his tools and goes to work. Just why there is such poor liaison between manufacturer and architect is perhaps ancient history. The important thing now is that a conscious effort be made by electrical manufacturers to bring about a better understanding.

To accomplish this it is essential that the manufacturer change his traditional point of view with respect to the architect. It is common practice to think of the architect as an office-bound, ultra-conservative specialist, chained to the past and non-progressive on things electrical. There are plenty of architects of this kind, of course. And there are still any number of them who continue to use the ancient wiring symbols that were discarded by the industry six or seven years ago, or who continue to inflict a private set of wiring symbols on the contractor, or who still do not know how to write electrical specifications. But by and large the modern architect is as commercially alert as the modern electrical manufacturer. He knows that this is the electrical age and he tries always to improve the electrical service which his specifications require. If instead of thinking of the architect as a "hopeless proposition," as one sales manager recently expressed it, the electrical manufacturer will cultivate the friendly good will of the architect, he will get farther in the long run than he does at present.

Architects have asked the manufacturers of equipment and materials used in construction work to cooperate with them by marking their advertising and trade literature with the file number designated by the American Institute of Architects. The electrical section of the institute's Standard Classification for Filing was recently revised and greatly improved. It would be difficult to lay one's hands on a piece of such literature which could not readily be classified under this system. And yet examination of manufacturer's catalogs and bulletins and instruction sheets shows that only a few manufacturers have complied with this request. Under the circumstances one can scarcely blame the architect for failing to do what the manufacturer himself has neglected to do. And it is little wonder that many a manufacturer's message fails to reach or to remain in the hands of the architect as it should. This request of the American Institute of Architects affords an excellent opportunity for developing a better understanding between electrical manufacturers and the men who write specifications for electrical installations, and it should therefore be respected by the manufacturing industry without delay.

Characteristics That Determine the *Selection* of MOTORS

No. 5 of a Series Discussing Motors of Different Types

An outline of recent developments in and an explanation of the characteristics of double squirrel cage and slip ring induction motors

BY THEODORE SCHOU
Consulting Engineer, Fairbanks, Morse & Co.

AND

C. P. ROBINSON
Synchronous Engineer Ideal Electric & Mfg. Co.

IN three of the previous installments of this series of articles dealing with Characteristics that Determine the Selection of Motors, which were published in ELECTRICAL MANUFACTURING for June, July and August, the discussion had to do with the principle features and divisions of constant speed motors, while in article No. 4 of the series, published in September ELECTRICAL MANUFACTURING, the subject treated was that of developments in synchronous motors. In this installment the characteristics of double squirrel cage and slip ring induction motors are explained.

Although a fairly recent development as compared to the standard induction motor itself, the double squirrel cage induction motor has already found numerous applications in the field of industry. This motor was developed in an effort to retain the simplicity of across the line starting for larger motors and also to obtain desirable starting characteristics.

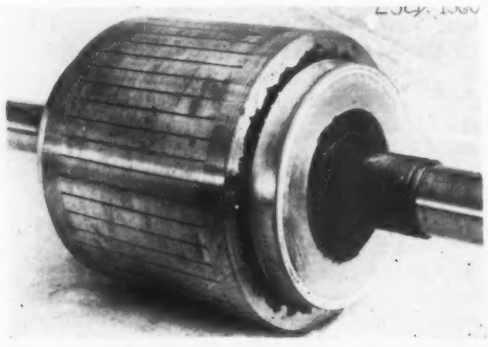


Figure 18 *is an illustration of a typical double squirrel cage rotor. It consists of two bar windings, a high resistance winding for starting and a low resistance running winding*

The double squirrel cage motor is usually built using the same frames and stator windings as the single squirrel cage motor. The rotor consists of two bar windings, a high resistance winding for starting purposes and a low resistance running winding. The bars are welded to end rings and thus retain the simplicty and sturdy features of the single squirrel cage rotor. No centrifugal starting device or starting resistance is necessary. Figure 18 shows a typical double squirrel cage rotor.

Due to the low resistance running winding, this motor has a low slip and a few points higher efficiency than the single squirrel cage motor. Its running power factor is usually slightly less but wherever its characteristics are suitable for an application, its advantages usually offset any disadvantage in power factor.

Characteristics of the Double Squirrel Cage Motor—In general the inrush current drawn from the line, during the starting period, will not exceed the N.E.L.A. limits up to approximately 40 hp. Above this limit the inrush will not exceed the inrush of the corresponding single squirrel cage motor started on the 80 per cent compensator tap. The starting torque will vary from 125 per cent to 200 per cent of full load torque. The maximum or pull-out torque will vary from 175 per cent to 225 per cent of full load torque.

The inrush and torque characteristics of a double squirrel cage motor when started directly across the line with full voltage applied are shown in Figure 20. These curves show how the torque is developed by the use of two rotor windings. Comparing Figure 20 with Figure 5 shows the advantages of the double squirrel cage motor as to starting torque and current inrush when compared to the single squirrel cage started on reduced voltage.

The control for this type of motor is very simple, consisting only of a manual or push button operated across the line switch, equipped with the usual protection for the motor.

The application for this motor is very much the same as

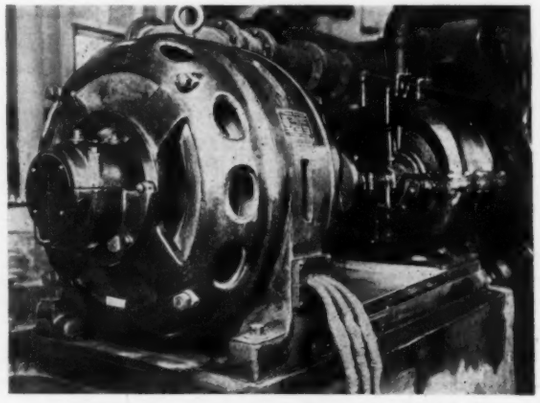


Figure 19 *shows the application of a double squirrel cage motor to a pump. These motors are ordinarily used where the requirements of starting torque at times reaches full load or more*

that of the single squirrel cage motor, except that this motor is usually used where the requirement of starting torque is full load or more. A few standard applications may be noted as for driving:

1—Compressors
2—Pumps
3—Cement mill machinery
4—Paper mill machinery
5—Flour mill machinery

There is also available a special high torque squirrel cage motor, constructed in the same manner as a double squirrel cage motor except that it has additional torque for such severe starting duty as required by automatic compressors, refrigerating machines, plunger pumps, loaded conveyors, etc.

This motor will develop from 250 per cent to 275 per cent of full load running torque with starting current within the N. E. L. A. limits. Its efficiency and power factor are not as good as the conventional double squirrel cage characteristics, but in its proper application, this motor is very satisfactory. Figure 19 shows the application of a double squirrel cage motor to pump drive.

Recently, there have been developments along the line of single squirrel cage motors so designed and constructed as to obtain nearly the same characteristics as available in the double squirrel cage motor. These motors have been designed primarily, with the idea in mind of decreasing production costs by increasing simplicity of construction. The

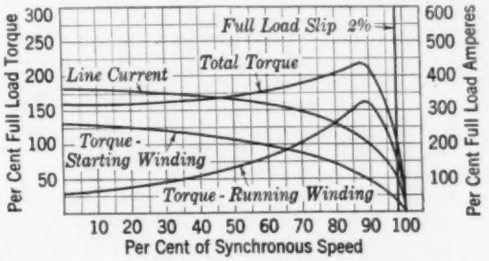


Figure 20 shows the inrush and torque characteristics of a double squirrel cage motor when started directly across the line with full voltage. Torque is developed by two rotor windings

General Electric Company has developed a motor of this type with a cast rotor construction. The stator frames are standard.

Figure 21 shows the assembled view of one of these motors, and Figure 22 shows the cast rotor used in the same motor.

The rotor bars are so shaped and located in the punchings

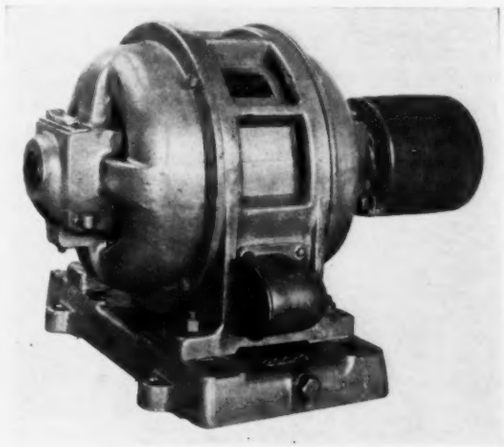


Figure 21 is an illustration of a double squirrel cage motor. They are used principally for driving air compressors, pumps, cement mills, paper mills, rubber mills and flour mills

that a high impedance is introduced at starting, resulting in low inrush current. The starting torque and pull-out torque, Figure 23, are almost identical with that of the double squirrel cage motor whose characteristics are shown in Figure 20. The starting torque is high enough to start

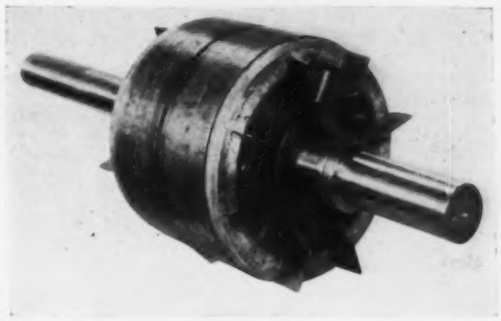


Figure 22 is a view of the rotor used in the motor shown in Figure 21. It is of the cast type and is so constructed that high impedance is introduced at starting resulting in low inrush

almost any load to which general purpose motors are applicable. This motor combines with the strength and sturdiness of a cast rotor, low slip, high efficiency and high power factor. The starting current meets N.E.L.A. starting current recommendations, except above 30 hp.

Among the applications recomended for this motor are driving pumps, fans, line shafts, etc. Figure 24 shows the single squirrel cage across the line start motor operating a Slurry agitator bridge in a cement plant.

The Crocker-Wheeler Electric Manufacturing Company has developed a single squirrel cage motor, with a unique rotor construction, limiting the current inrush to within N.E.L.A. limits and developing a starting torque of 110 per cent of normal full load torque.

The rotor of this type of motor is built up of U shaped bars, one side of which is placed in the slot on the surface of the iron, and the other side forms a return path directly beneath, under the rotor core which is supported on a spider. The ends of the U shaped bar are welded together. No end rings or connections in the circumferential direction are used. This new type of construction is well adapted to rotors of large size, since the usual difficulty due to stresses set up in large diameter end rings by expansion and contraction is eliminated. They are used principally for the same applications as other types of motors described previously in which rotors of large size are required.

The slip ring induction motor will be considered in this article only from the standpoint of constant speed application. The slip ring motor consists of the usual polyphase

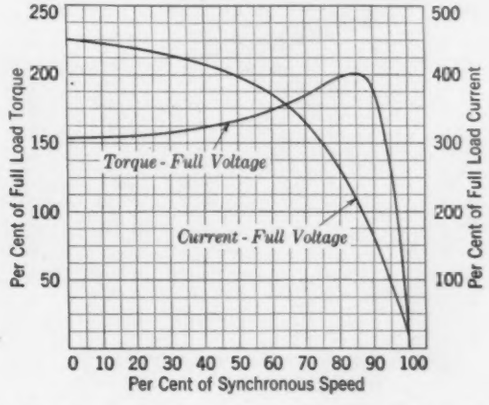


Figure 23 shows that the starting torque and the inrush torque of the cast rotor shown in Figure 22 compare very favorably with the characteristics of the rotor plotted in Figure 20

wound stator and a rotor also polyphase wound. Figure 25 shows a typical rotor for a slip ring motor. Note that the rotor winding is banded at each end. This is necessary to keep the rotor coils from flying out due to the centrifugal force at high peripheral speed. It will also be noticed that the rotor winding is placed in open slots instead of semi-closed slots as in the case of the squirrel cage rotor. The result of this is a loss in efficiency and power factor

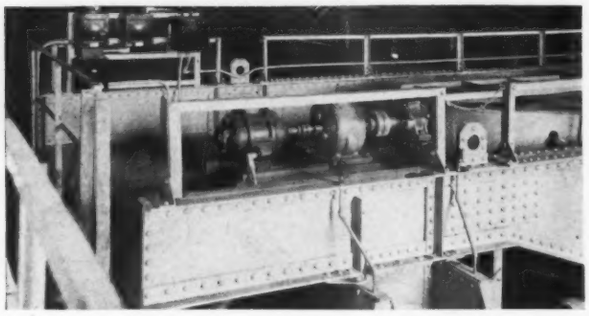


Figure 24 is an illustration of a single squirrel cage, across-the-line-start motor as it is employed to operate a Slurry agitator bridge in a cement mill, which is a typical installation

during the running operation. However, this loss may be offset by a gain in characteristics for a particular installation.

Primarily, the slip ring motor has an advantage in that its inrush current can be varied by varying the resistance in the secondary or rotor circuit. Generally it may be said, that as far as constant speed operation is concerned, the slip ring motor will be used only where it is essential that a motor have unusually low inrush current and good starting torque. Approximately, it may be said that by using the proper resistance, a slip ring motor will develop 100 per cent starting torque with only 125 per cent inrush current drawn from the line. This would be very advantageous on the end of a long transmission line or in a plant

Figure 25 shows a typical rotor for a slip ring motor. It consists of the usual polyphase wound stator and a rotor also polyphase wound. Note that the rotor winding is banded at each end

of small capacity, where high inrush would lower the voltage too much.

The current, torque, and power factor characteristics of a small slip ring motor without resistance in the rotor circuit, or in other words with short circuited secondary are shown in Figure 26. When resistance is introduced into the secondary the starting current can be reduced and good torque maintained. The maximum or pull-out torque, about 250 per cent, can be secured at starting with an inrush current of very little over 300 per cent of full load current.

The applications for this motor are much the same as for the other types of motors, particularly when used because of low inrush requirements. However, it has other applications where heavy starting torque is required such as steel mill, flour mill, rubber mill, and cement mill or similar drives. It is used for fire pump duty to meet Underwriter's specifications. Figure 27 shows a slip ring motor driving a rail mill, and Figure 28 shows a slip ring motor driving a water pump.

Slip ring motors are operated and controlled through a drum type resistance starter with protection for the motor incorporated. For the same rating, the slip ring type motor will cost approximately 75 per cent more than the squirrel cage type, for an average range of speeds and horse power ratings.

Mechanical Features—The standard type of motor is built in open type frames with sufficient ventilating ducts and provisions for cooling. Then, there is the semi-closed type of frame, where the upper part of the bracket is closed to pro-

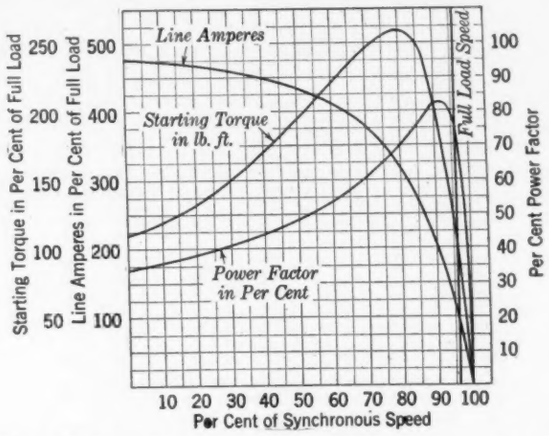


Figure 26 shows the current, torque and power factor of a small slip ring motor without resistance in the rotor circuit, or in other words, with short circuited secondary rotor windings

tect the motor from dirt accumulations from overhead. Also, there is the closed type and gas proof type for operation in places such as in flour mills where the dust is exceedingly bad, or for operation in mines where there is constant danger of explosions.

Practically all types of induction motors are available built in vertical frames for pumps, ceiling mounting, and other special applications.

Bearings—Practically all of these various types of motors have been developed recently so that the buyer may have his choice of sleeve bearings or ball bearings, and sometimes roller bearings. Many motor manufacturers are using ball bearings as standard equipment.

The friction of ball bearings is so low that there is almost no wear at all. The life of bearings is thus prolonged almost indefinitely with proper care. Careful investigation and tests have shown that ball bearing motors do not require lubrication more than once a year. Such tests have also proved that the use of ball bearings will increase the motor efficiency as much as one per cent in most instances. These

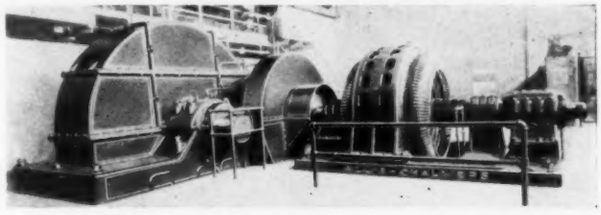


Figure 27 is an illustration of a slip ring motor driving a rail mill. The applications of this motor are much the same as for other types, particularly when used because of low inrush

facts tend to decrease operation costs and maintenance costs, and give the buyer longer service, with the minimum of attention on his part.

The use of ball bearings is not limited to small motors. Large numbers of belted ball bearing motors are in use, in capacities up to 250 hp. Motors have been equipped with these bearings for even larger ratings, up to 500 hp. The ball bearings on the large motors give equally as good service as those on the small motors.

Thus it may be seen that the question of proper bearings

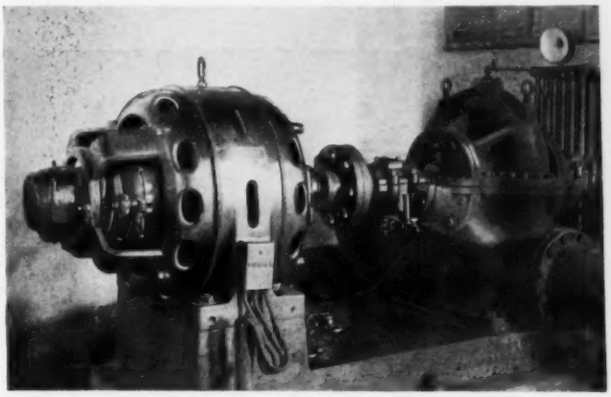


Figure 28 is an illustration of a slip ring motor as it is used for driving a pump. Many of them are driving fire pumps and similar apparatus as they meet Underwriter's requirements

is an important one and should be carefully investigated in connection with the application of motors.

The shunt wound direct current motor and the shunt wound motor with series characteristics of starting are commonly used for the same type of drives as given for induction motors, where only direct current is available. It is a well known fact that the series wound direct current motor has a very high starting torque. This fact is made use of in special shunt wound direct current motor applications by using a series winding that is connected in the circuit only during the starting period.

Figure 29 shows the usual speed load curve and torque load characteristic for a typical shunt wound direct current motor. It can be seen that the speed varies very little from no load to full load and also that the torque characteristic is a straight line relation, the torque being directly proportional to the armature current, with a field rheostat left in a given position. Figure 29 also shows how the

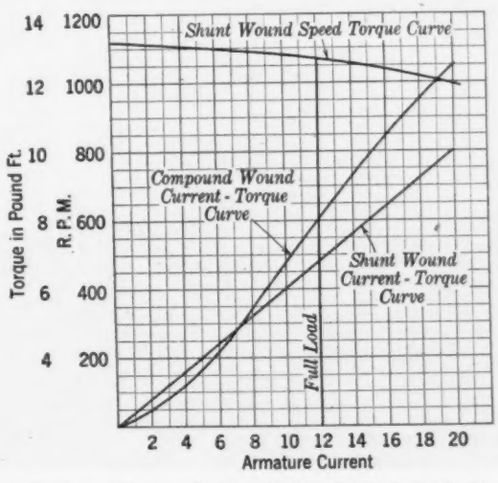


Figure 29 shows the usual speed-load and torque-load characteristics of a typical shunt wound direct current motor in which the speed varies but very little from no load to full load

effect of series winding increases the torque for starting purposes.

Several applications of direct current motors are shown in the accompanying illustrations. Figure 30 shows a direct

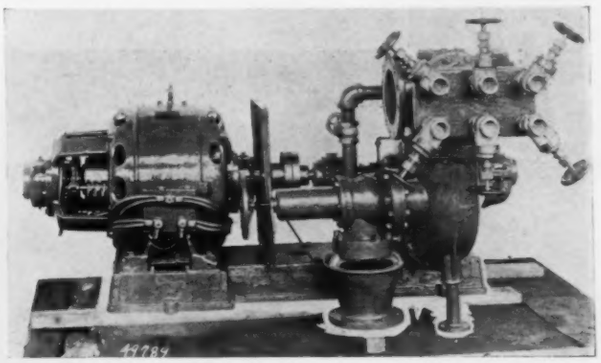


Figure 30 is an illustration of the connection of a direct current motor to a fire pump. Different applications of similar motors may be seen in some of the other illustrations

Figure 31 is another illustration of a direct current motor on a vertical pump drive. This is typical of the wide use to which these motors may be applied where direct drive is desirable with vertical pumps

current motor direct connected to a fire pump. Figure 31 shows a vertical direct current motor on pump drive. Figure 32 shows a direct current, 3 bearing motor belted to a compressor.

Direct current motors use a resistance starting box to control the starting current and to provide the torque as required. The resistance is gradually cut out as the motor comes up to speed, so that the current is never much over full load current, unless the starting load is very heavy.

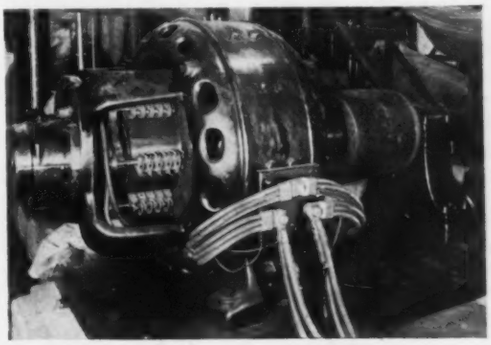
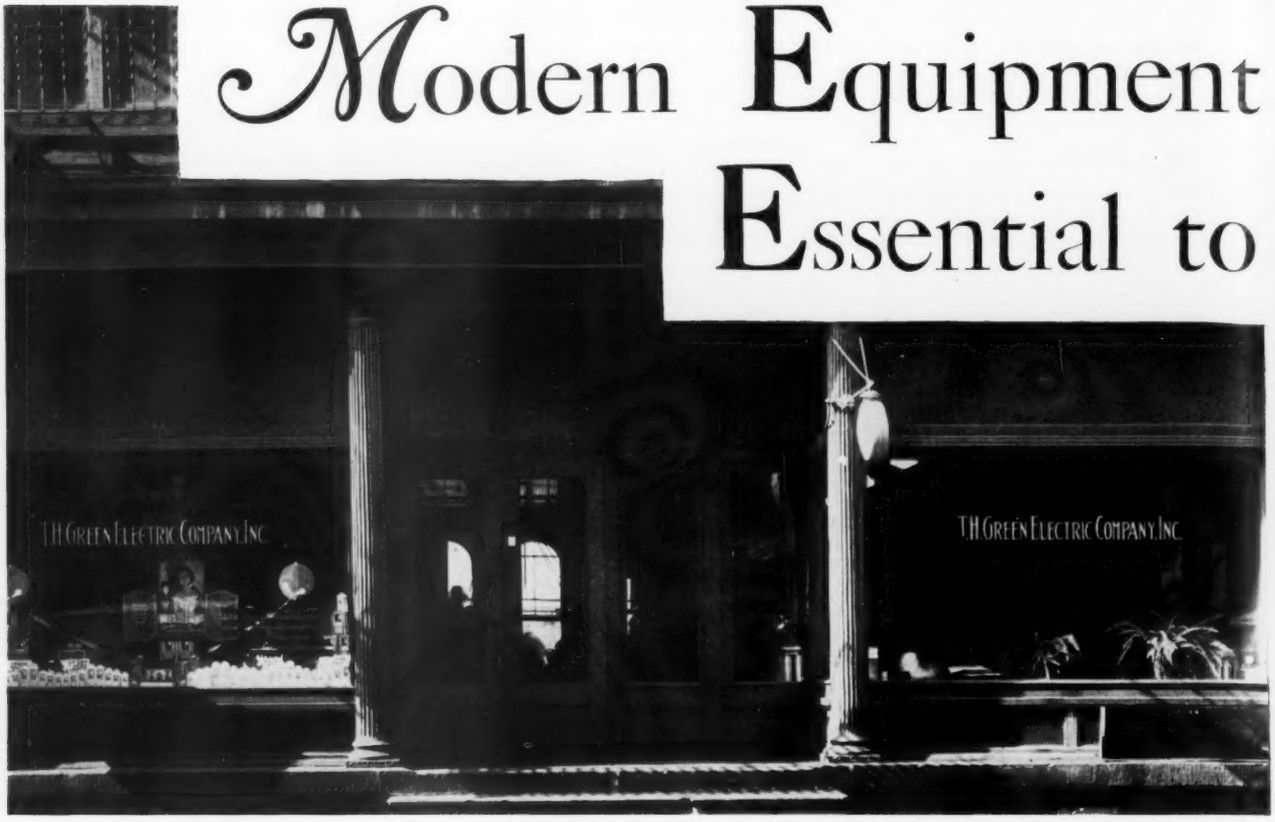


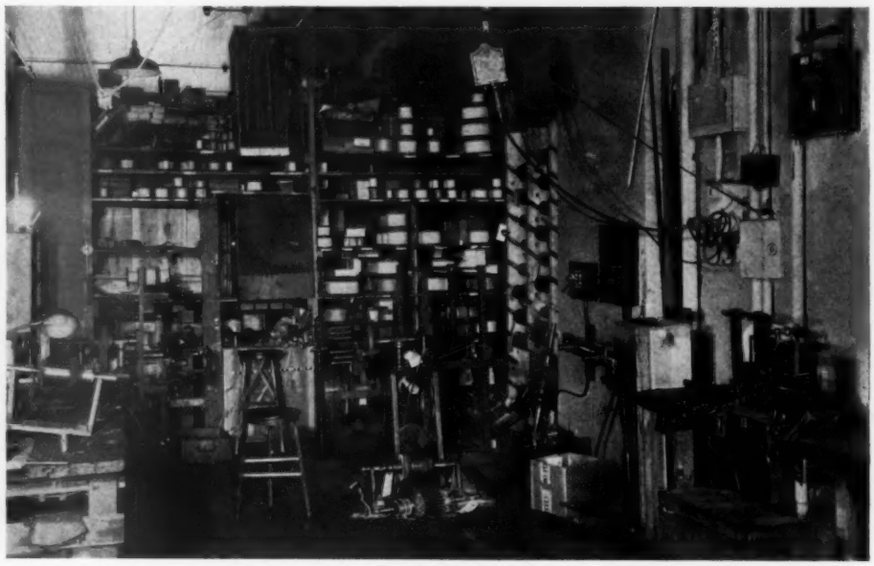
Figure 32 is still another example of the uses of direct current motors. This view is of a three bearing motor as it drives an air compressor through a pulley and belted connection

Modern Equipment Essential to



IN and about Rochester, N. Y., there are many manufacturing plants in which much of the machinery and other equipment is electrically driven. Some of these plants, particularly the larger ones in which electrical maintenance and motor repair work are extensive, have adequate facilities and forces of trained workmen for reconditioning motors, generators, controllers and other similar electrical devices. Some of the other plants, in which there is not enough work of this kind to justify the installation of special equipment for electrical repair work alone, depend largely upon the local motor repair shops for the maintenance of their electrical equipment. There are several of the latter in Rochester, fully equipped in every respect to undertake almost any kind of repair work, and probably one of the largest is the T. H. Green Electric Company, Inc., 31-37 N. Water Street.

Twenty-seven years ago this organization was established as the Wheeler-Green Electric Company, and for twenty-five years subsequently it continued to conduct a general contracting and electrical manufacturing business. Two years ago the old company was reorganized and incorporated under its present name with T. H. Green as president, taking over at the time all of the former business and contracts of the original organization. Today, no doubt because of its long record for efficient and satisfactory service in the community it serves, the T. H. Green Electric Company ranks among the best in the electrical business in Rochester. Its establishment is located in the center of the business district of the city and while electrical contracting is the principal business of the company motor repairing and the manufacturing of panelboards also play an important part in the organization's activities. The company occupies the entire four-story building at its present address with offices, salesrooms, warerooms and its manufacturing plant, and aside from



A view in the coil winding department of the T. H. Green Electric Company, Inc., of Rochester, N. Y., showing the orderly arrangement of equipment with the convenient location of the spooled wire and insulating materials. Notice the modern machines and the large working area

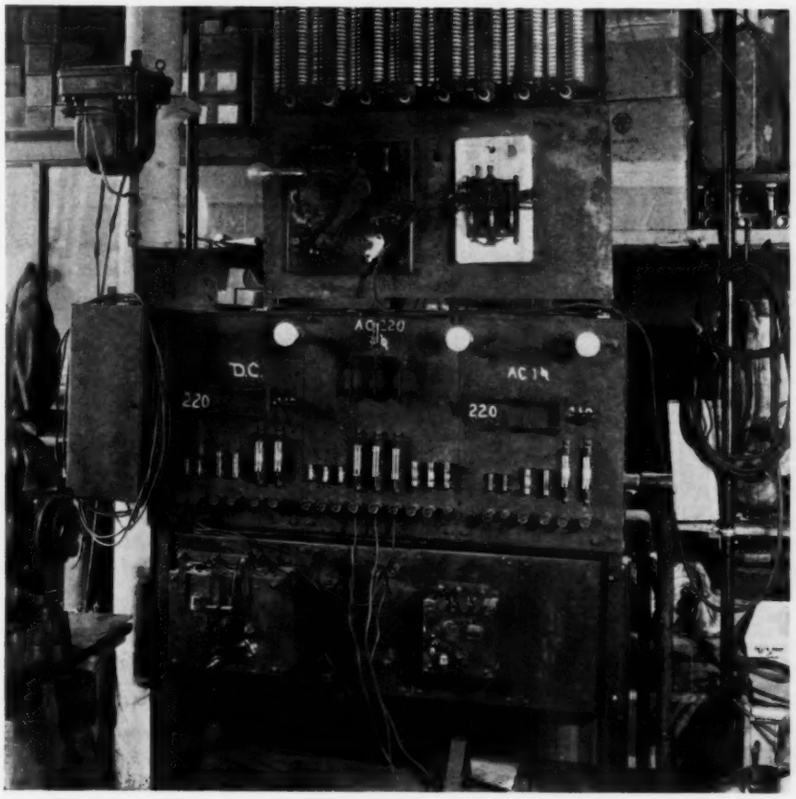
and Practical Methods Motor Repair Business

A description of the methods employed in the motor repair shop of the T. H. Green Electric Company, Rochester

By William W. Baxter
Associate Editor, Electrical Manufacturing

Some of the heavy machine tools in the motor repair shop of the T. H. Green Electric Co., Inc., Rochester, N. Y.

office and other clerical employees, the company has an average of twenty workmen in its shops, with from twenty-five to fifty electricians in the field. All of these workmen are skilled mechanics in their respective lines so that the T. H. Green Electric Company, with its full complement of manufacturing and other shop equipment is adequately fitted to undertake any kind of electrical repair work or field installations.



The control board for the test equipment in the motor repair shop of the T. H. Green Electric Company, Inc., of Rochester, N. Y. Every piece of apparatus entering or leaving this shop is thoroughly tested and inspected with all the necessary facilities

The manufacturing and repair departments of the company occupy the entire rear half of the first floor of the building and in them are to be found all manner of machinery and similar equipment necessary for the reconditioning of electrical apparatus or the building of panelboards. Of course, the operation of these two departments is very similar to that of other motor repair shops, except that the arrangement and grouping of the machines is somewhat different, while many of the processes and forms for recording labor and materials are rather novel in their respective functions. In the first place there is ample floor space in the shop for all of the equipment, thereby eliminating crowding, and the lighting arrangements are such that it is seldom that the work cannot be carried on under natural light.

Essentially the shop is divided into five separate sections: one for work on coils, another for dismantling and assembling operations, one for machine work, one for the making of panelboards and the test department, where every piece of apparatus either entering or leaving the shop is thoroughly inspected and tested for defects and satisfactory performance. In fact it is an established practice with the T. H. Green Electric Company to guarantee every job that leaves its shops, both for materials and workmanship for a period of one year.

Inasmuch as all of the operations incident to rebuilding a motor or a generator, for example, are essentially the same in all repair shops it should not be necessary to enter into a detailed description as to how similar work is performed in this shop, other than to say that it is an established practice with the T. H. Green Company that every job entering its plant must undergo a thorough inspection, and any defects so found are entered on a form provided for that purpose, together with a job number and a description of the device to be reconditioned. The next step is that of dismantling the device to get at the defective parts. All of this work is performed on suitable benches with the necessary hand tools. Once this is done repairs are made as are required and the device is reassembled, after which it is again tested as has been explained.

In the way of facilities for making repairs the T. H. Green Company has provided well for each section of its shop. The coil winding section, for example, is shown in one of the accompanying illustrations. In this department there are two coil winding machines, a coil spreader, a taping machine and the necessary bench facilities for removing and assembling coils. It should also be understood in this respect that adequate equipment is available for dipping and baking coils and armatures. Furthermore, the coil winding equipment and the baking ovens were especially built for the shop by the T. H. Green Company. It will be noticed from the illustration of the coil winding department that large quantities of spooled wire and all manner of insulating material are carried in stock at all times and they are stored conveniently near the department in which they are used.

In connection with the stock department or storerooms of the T. H. Green Electric Company it should be interesting to know that no stockkeeper is employed. Employees draw materials on requisition as they are needed, and these in turn are charged from the requisitions directly against the different jobs. The reason for this is that after so many years in repairing electrical equipment and in manufacturing panelboards those in charge of the work know full well just how much material of any one kind should be charged against a job. Of course, this practice requires considerable effort to determine that the correct amounts are charged against the various jobs, but it has this decided advantage. It saves the company the expense of a stock clerk, who ordinarily would be required to spend only part of his time in the stockroom. On the other hand, were there any losses of materials these would not nearly equal the annual wages of a stock clerk.. As the company handles its materials and storerooms now a complete check of all materials on hand is made about once in every two weeks. From these reports new stock is ordered and at the end of each year the amounts on hand, and those used are checked against the purchases for that year. It has been found after following this practice for a number of years that the losses of materials are almost negligible, and the company feels that it is actually reducing its operating expenses by eliminating a stock keeper.

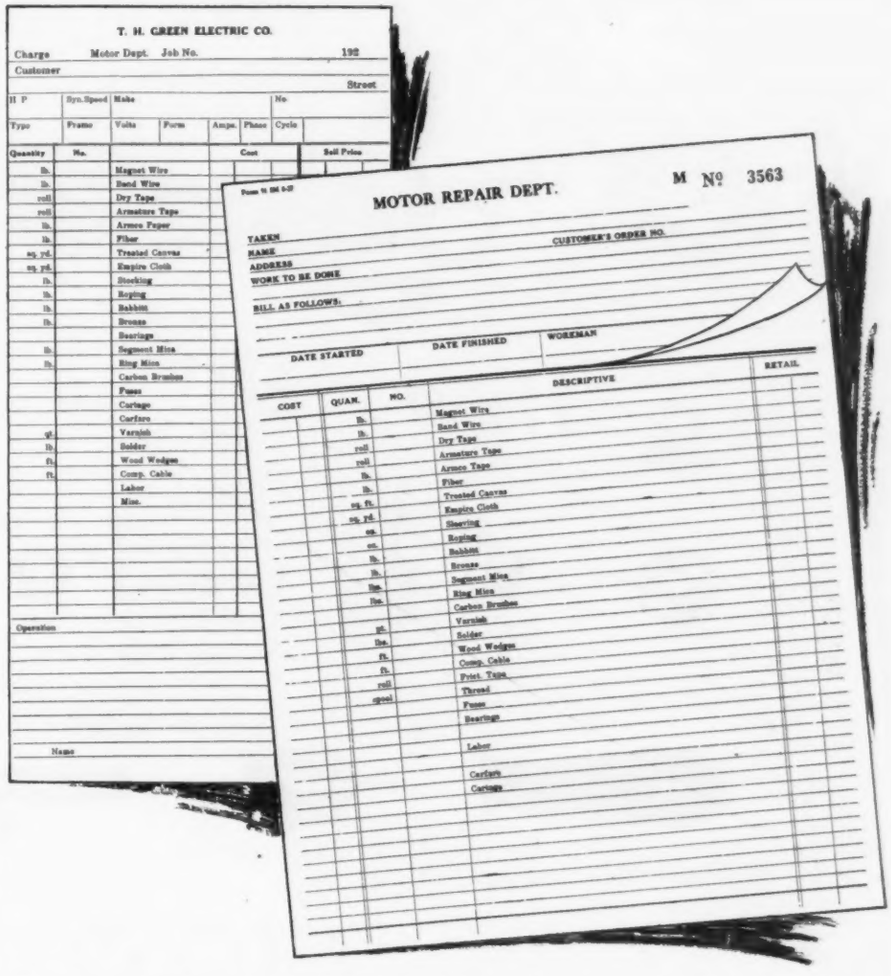
Another interesting feature in connection with operating expense, or overhead, is that this is determined monthly, so that the company does not have to operate for a year, as many others do, without knowing exactly the financial standing of its business. This has a very important advantage too, in that charges and other costs can be adjusted to suit current needs, rather than make these corrections maybe months after it is too late to compensate for them in the current year's business.

Since much of the motor repair work in the T. H. Green shop is of a heavy nature, large machine tool facilities are required. Some of these are shown in the accompanying illustrations and among them are large lathes and radial drill presses. It should be understood in this connection that some of these machines are also used in the production of panelboards. Little is needed in the dismantling and assembling sections of the shop other than hand tools and hoists, while the testing facilities include the usual control board, from which any desired current may be obtained.

Three of the record forms used in the motor repair shop of the T. H. Green Electric Company, Inc., of Rochester, N. Y. At the upper left is a data card and at the upper right is the back of the same card. One of these is filled out as a permanent record for every motor repaired in the shop. Below at the left is the office time sheet and at the lower right is the workman's time slip

Probably the most interesting thing about the T. H. Green Electric Company's motor repair shop is the forms it employs for recording amounts of labor and materials used on the different jobs. One of these is a data card. This is a standard form approved by the General Electric Company for use in motor repair shops and by industries that desire to maintain accurate records of the services, condition and uses of their electrical equipment. On the face of this card are spaces for entering the characteristics of a motor or generator such as the horsepower, speed, winding and the device number. Below these are spaces for data relating to the motor frames, poles, volts, cycles and the like, while additional space is provided for recording characteristics of control equipment, and various desirable information about the coils, bushings, linings and pulley equipment. On the back of the card is the service record. These spaces indicate the service of the device and its condition at all times. One of these forms is made out for every motor or generator as it comes into the shop of the T. H. Green Company and after the work is completed these forms are filed for future reference.

For the purpose of keeping accurate records of labor on all the many different jobs it handles the T. H. Green Company uses two time sheets. Both of these are shown in the accompanying illustrations. One of them is filled out by the workmen in the shop. One sheet is used by each mechanic and on it he enters his name, department, the date, the job number and the nature of the work he performs. At the bottom of the slip is space for the foreman's approval and the total number of hours. These records are transferred to office time sheets that serve as permanent records of all labor on all the various jobs. These are kept in a loose-leaf book for permanent reference, and as may be seen from the illustration, they contain spaces for a date, name and job number, with columns for entering the workmen's time, its actual cost to the company and the amount of billing to the customer.



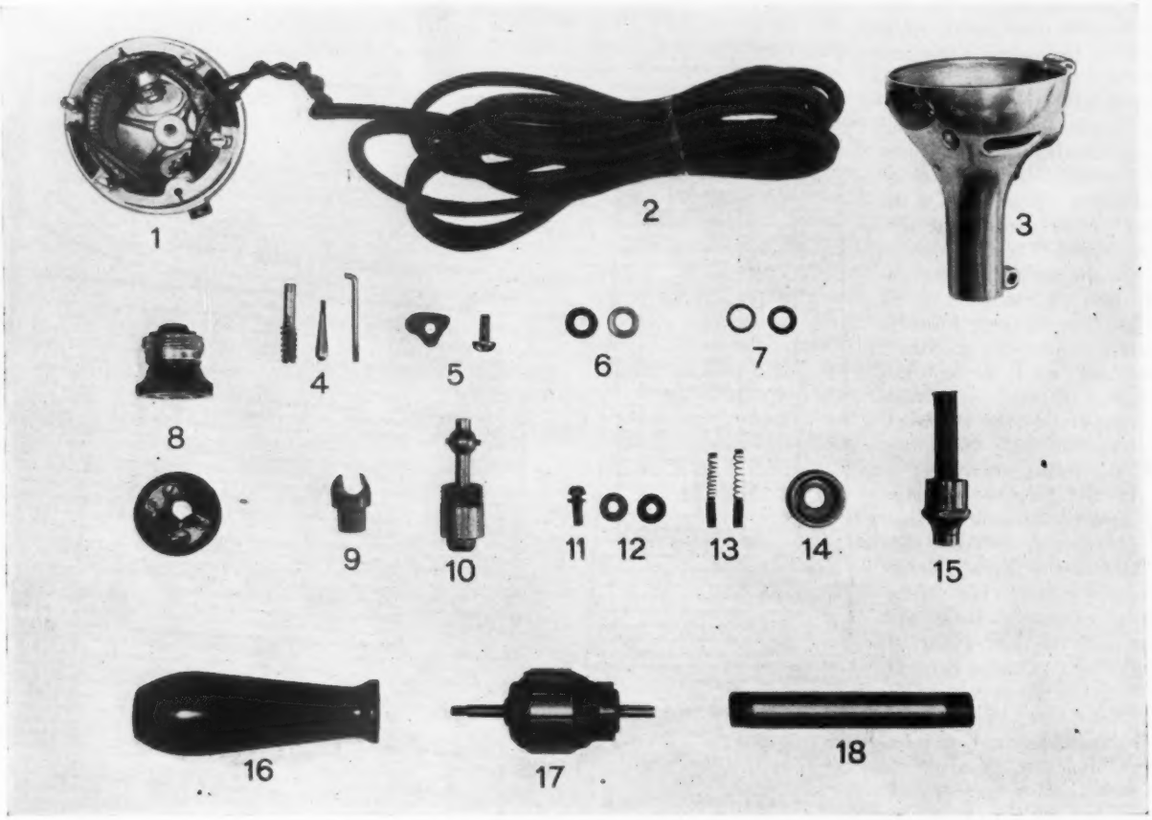
This illustration shows samples of the material records kept by the T. H. Green Electric Company, Inc., of Rochester, N. Y. One of these is made out by the workman in the shop, to insure an accurate charge of all materials, and the other is filled out in the office as the job record

Another interesting form is that used for recording materials required on the different jobs. There are two of these forms, both very similar in appearance as can be seen from the illustrations of them. One of them, the smaller of the two, is used in the shop. At the top of this are spaces for the job number, the customer's name and address and a fairly complete description of the device. Below, and arranged in a long column, are listed the most important kinds of materials used in reconditioning motors and generators. In the first column is space for the quantity of material either in pounds or some other unit measure. Next is a column for the item number of the material or the gage number of the wire, while the third column lists the material itself, with an additional column for its shop cost and the last column for its selling price to the customer. One of these is made out in the shop for every job undergoing repairs. When the work is completed these are checked against the job, as has been previously explained, to determine that too much material of any one kind was not charged out. After this has been done the forms are passed on into the office where the various items of material and their costs are transferred to the larger of the two forms, the latter serving as a permanent record. On this form, in addition to the information contained on the shop form, are spaces for recording operations performed on the job, with the dates the work was started and finished.

There are many other interesting things about the T. H. Green Electric Company, particularly in the way of service and the manner in which it operates its contracting business, but as may be seen from the foregoing, with such a full complement of machinery and other facilities, with a well organized and systematic plan of operation in its shop and with a carefully trained staff of mechanics and supervisors using such novel forms for recording costs of materials and labor, the T. H. Green Electric Company is well fitted to undertake any kind of electrical work and at the same time render satisfactory and efficient service to its customers, many of whom have been patrons since the beginning of the business.

Vibrator Components

Unofficial estimates by the Department of Commerce place the production of vibrators at 150,000 a year with a valuation of $1,150,000



ELECTRICAL MANUFACTURING *acknowledges the assistance of the Halliwell-Shelton Electric Corporation, 113 Fourth Ave., New York, N. Y., in the preparation of the illustration of electric vibrator parts*

Part No.	Description	Material	Annual Production
1	Motor stator and bearing housing	Steel laminations, aluminum die casting, bronze bearing	150,000
2	Attachment cord	Cotton covered flexible copper wire	150,000
3	Housing	Aluminum die casting	150,000
4	Stroke adjusting lever	Steel	150,000
5	Switch arm and screw	Fibre, steel	150,000
6	Cord bushing and washer	Soft rubber and brass	150,000
7	Vibrating mechanism washers	Leather, brass	150,000
8	Attachment plug	Copper, brass, hard rubber	150,000
9	Vibrator cam	Bronze	150,000
10	Vibrator joint	Steel, bronze	150,000
11	Housing bolt	Steel	150,000
12	Motor armature washers	Fibre, felt	150,000
13	Motor brushes and springs	Carbon, steel	300,000
14	Housing end cap	Steel	150,000
15	Cord protecting spring	Steel	150,000
16	Handle	Wood	150,000
17	Motor armature	Steel, copper, insulation	150,000
18	Housing nipple	Iron	150,000

Are you supplying your share of the raw materials and parts required for the annual production of

150,000

electric vibrators, having a total valuation of $1,150,000?

Carboloy—a New Metal with Unusual Properties

Harder than tool steel this new development in cutting metals readily machines glass, porcelain and molybdenum with little apparent wear

By Dr. S. L. Hoyt*
Research Laboratories, General Electric Company

CUTTING a screw thread in a glass rod, boring a smooth hole in a block of concrete, machining porcelain on a lathe, and cutting the hardest of steels—things difficult or even impossible with present-day machine tools—are among the things that can be done easily with a new kind of machine tool material announced by Dr. Samuel L. Hoyt of the Research Laboratory of the General Electric Company at the annual convention of the American Society for Steel Treating, at Philadelphia on Oct. 11. The new material, named carboloy, is composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt giving it the necessary strength required in high-speed metal cutting tools.

Dr. S. L. Hoyt

Carboloy Threads Glass Rod

THE possibilities of the new tool material were indicated by Dr. Hoyt in his references to experiments conducted with molded materials containing metal inserts, such as fabric gears used in automobiles. Cobalt-chromium alloy cutters, which had given the best previous service in this work, required redressing for every 150 parts machined; the new tungsten carbide tools, operating under identical conditions, finished 11,000 parts before sharpening.

"The peculiar virtues of tungsten carbide promise to make it the dominant tool material in the field of weak or 'low tensile' materials, which are also uncommonly abrasive to present tools. Here the durability of carboloy tools has been found to be of the order of 25 to 75 times that of high speed tools," Dr. Hoyt said. "The new material can machine harder and denser grades of steel than can be handled economically by high-speed steel; and steels with higher alloy contents than are now commercially machinable will be brought into the machinable class."

Usual cutting tools will not affect a glass rod; instead, a rod of glass in a lathe will wear off the edge of a cutting tool that is pressed against it. The tungsten carbide tool quickly cuts into the glass, and can even be used for cutting a screw thread into the rod. Likewise, hard porcelain insulators can be machined on a shaper with the new material. For drilling a hole in concrete and rock it previously was necessary to use either an expensive diamond drill or a "star" hammer, which really breaks its way roughly through the concrete. A drill made with the new cutting material has advantages over both of its predecessors, in that it is less expensive than the diamond drill and that it cuts a smoother hole than does the "star" hammer drill.

Hadfield's manganese steel, previously in the non-machinable class of metals, was found to yield so easily to the new cutter that commercial operation is expected to be developed. Similarly, in the General Electric research laboratory it has been found that numerous experimental alloys can be handled by tungsten carbide cutters, although not with the usual tools. It was found that even a block of quenched high-speed steel could be machined on the shaper with the new material, although with difficulty, and that the same held true with the super-high speed cobalt-chromium alloys.

In testing high-speed steel it is customary to use a nickel-steel test log, operating at about 50 feet per minute. Because of the lack of effect on the new cutter however, it was necessary to increase the speed to 200 feet per minute. At this higher speed a high-speed steel cutter failed in 16 seconds, with its edge burned off. The tungsten carbide tool, operated under identical conditions, was run for an hour before the test was arbitrarily stopped, and the tool was still cutting and capable of cutting for a much longer period of time. In another run with a test log of chromium-nickel steel, with a cut of ⅜-in. and a feed of ⅛-in., good high-speed tools failed in from six to eight minutes when operated at 35 feet per minute; carboloy tools, with the same cut and feed but at 70 feet per minute, twice the speed, showed but little wear after 10 minutes.

Eliminates Taper in Boring and Turning

ONE difficulty with today's tools has been that wear of the tool causes a taper. In machining a hollow cylinder of carbon, for instance, the best tool steel loses its cutting edge and begins cutting a taper soon after starting; tungs-

* *Excerpts from an address by Dr. Hoyt, at the annual convention of the American Society for Steel Treating, in Philadelphia, October* 11, 1928.

ten carbide tools take an entire cut without tool wear, and hence without tapering.

Genelite, composed of copper, tin and carbon, is so soft it can be whittled easily with a knife, but it is also so abrasive that it dulls a steel tool almost at once. A cut on a small cylinder of only a few inches in length has always been on a taper; here again the tungsten carbide tools have not been worn, and hence the cuts are not tapered.

Shows Little Wear from Abrasion

THE bearing surfaces of commutators of electric motors, of alternate layers of mica and copper, have always presented a problem since they must be accurately machined and since mica is very abrasive. Here also the new material gives a smooth finish without undue wear.

Molded compounds, such as bakelite, and hard rubber also wear tools quickly. Diamond tools are used with bakelite since these stones have been the only material to stand up at the high cutting speeds used. If the bakelite contained a metal insert, however, a special operation was needed since the diamond would be broken if it struck the metal at high speed. With carboloy no special operation is required.

When considering cast iron, cutting conditions are found to be much different. The parts are frequently large, the cutting speeds are lower, the cuts are heavier, and the tool pressures greater. One of the most difficult jobs with cast iron has been the removal of the surface layer of chilled metal, particularly if the surface contains sand. The chilled iron and sand are harder than tool steel, so that the edge of the cutter is taken off almost at once. Tungsten carbide, however, is harder than the surface of the cast iron, so that it can handle work of this kind without difficulty. In fact, the same speeds and feeds can generally be used for the surface as for the sub-surface cuts. Hard castings can be handled as easily as soft ones with the new material; and intermittent cuts are also handled satisfactorily.

The windows in the laboratory rooms bear witness to the extreme hardness of the new cutting material—deep scratches have been made in the glass, just as though a diamond had been used. Natural sapphire, next below diamond in the scale of hardness, is also scratched by the tungsten carbide. If carboloy is held against the side of an emery grinding wheel, a deep, narrow groove is worn in the stone, without the carboloy suffering much loss, whereas ordinary tool materials are worn away.

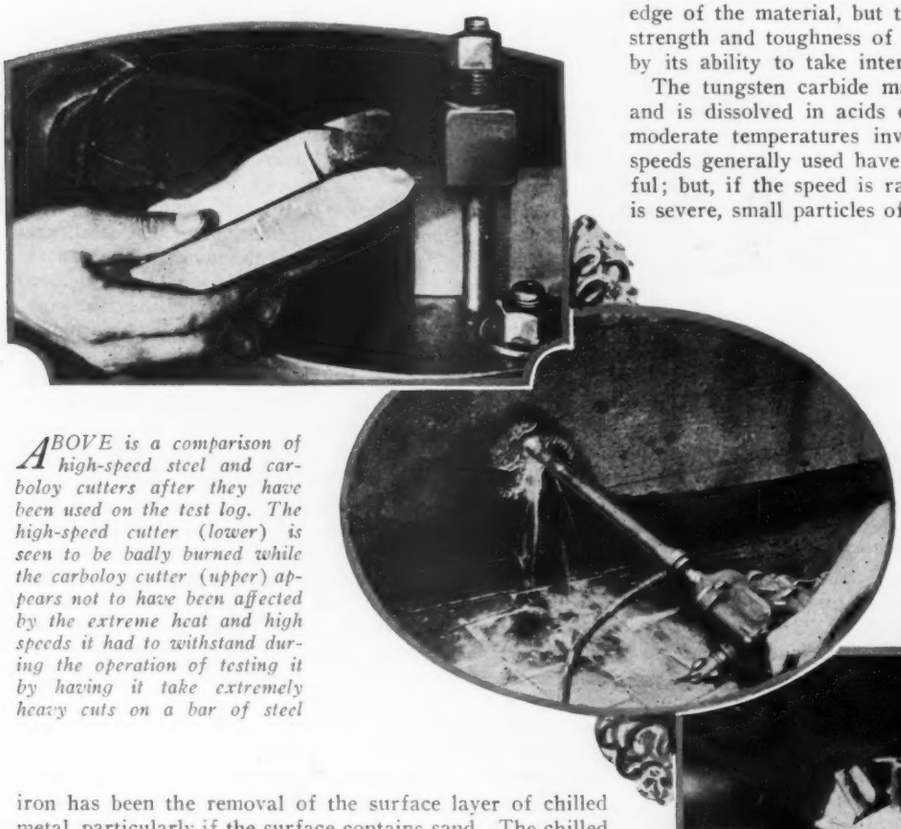
When it came to determining quantitatively the hardness of the new cutter, it was found that the usual method of using the Rockwell test was not of service—the point of the diamond wore and crumbled in too short a time if the diamond penetrator was loaded with a weight. It was necessary to use the penetrator without a load. The test showed that common hardened tool steel has an average maximum hardness of 850 on the Brinell scale, that the hardest steel may be taken as about 1000, and that the hardness of carboloy runs 2000 and above.

Carboloy Has Unusual Strength

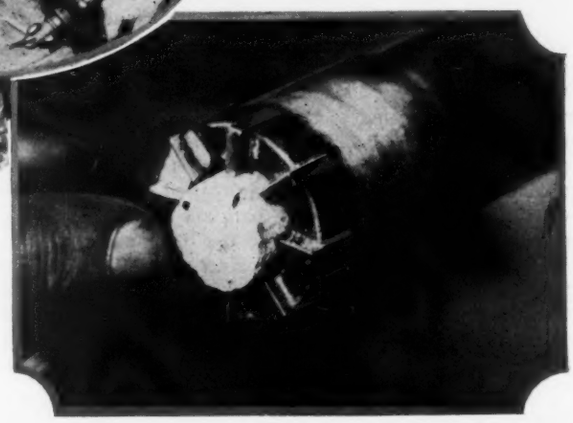
THE addition of cobalt to the tungsten carbide increases its strength to more than half that of high-speed steel. Tungsten carbide without cobalt has a strength of less than 50,000 lb. per sq. in., carboloy up to 275,000 lb., and quenched and tempered high-speed steel 425,000 lb.

Another important property of a cutter is toughness, and the new material will withstand quite severe blows of a soft peen on the edge of a bar. A supporting block of copper shows marked indentations as a result of the blows on the edge of the material, but the edge does not crumble. The strength and toughness of the material are further shown by its ability to take intermittent cuts on metals.

The tungsten carbide material does not pit or tarnish, and is dissolved in acids only with great difficulty. The moderate temperatures involved in cutting metals at the speeds generally used have not been observed to be harmful; but, if the speed is raised too high and the abrasion is severe, small particles of carbide may oxidize and shoot



ABOVE is a comparison of high-speed steel and carboloy cutters after they have been used on the test log. The high-speed cutter (lower) is seen to be badly burned while the carboloy cutter (upper) appears not to have been affected by the extreme heat and high speeds it had to withstand during the operation of testing it by having it take extremely heavy cuts on a bar of steel



AT the left may be seen a carboloy cutting tool boring into solid concrete, an unusual operation for any kind of steel and one that will speed up this work materially in the future. The view below shows the cutter with a concrete slug in its center after it had completed the operation of drilling through the concrete wall shown at the left. Notice that the cutting edges of the tool show but little wear

off from the edge as sparks. Ordinarily the temperatures involved simply produce temper colors, much the same as they do with high-speed steel.

The material retains its strength and hardness at elevated temperatures to a remarkable degree. Tools have been observed cutting nickel steel when the point of the tool was at a bright red heat, without showing any ill effects. The material has no "temper" to be "drawn" by the heat generated, and it is actually much harder than the materials machined, even at elevated temperatures. Steel tools, on the other hand, are frequently softer than the machined materials.

Has a Density of 14 Grams per C. C.

IT has long been known that tungsten carbide is a hard material; and, since this great hardness was first recognized, many attempts have been made to utilize it commercially. The carbide, however, is too weak and porous for most industrial applications of hard materials, and this accounts for the efforts which have been made to increase its strength. Obviously this strengthening must be accomplished at too great a sacrifice in hardness.

German investigators have been particularly active in this field, as shown by the various German patents covering tungsten carbide. One of their important developments (a contribution of the incandescent lamp industry), is the tungsten carbide and cobalt combination, represented by the "Hartmetall" of the Osram Co. By means of cobalt, tungsten carbide is made about half as strong as high speed steel, while retaining sapphire-scratching hardness.

In the writer's opinion, great credit is due the inventors of this carbide tool material. These carbide tool materials seem destined to play a dominant part in the industrial life of the future. Various forms of carbide tool materials have been studied by the General Electric Co., both in its research laboratory and in its shops.

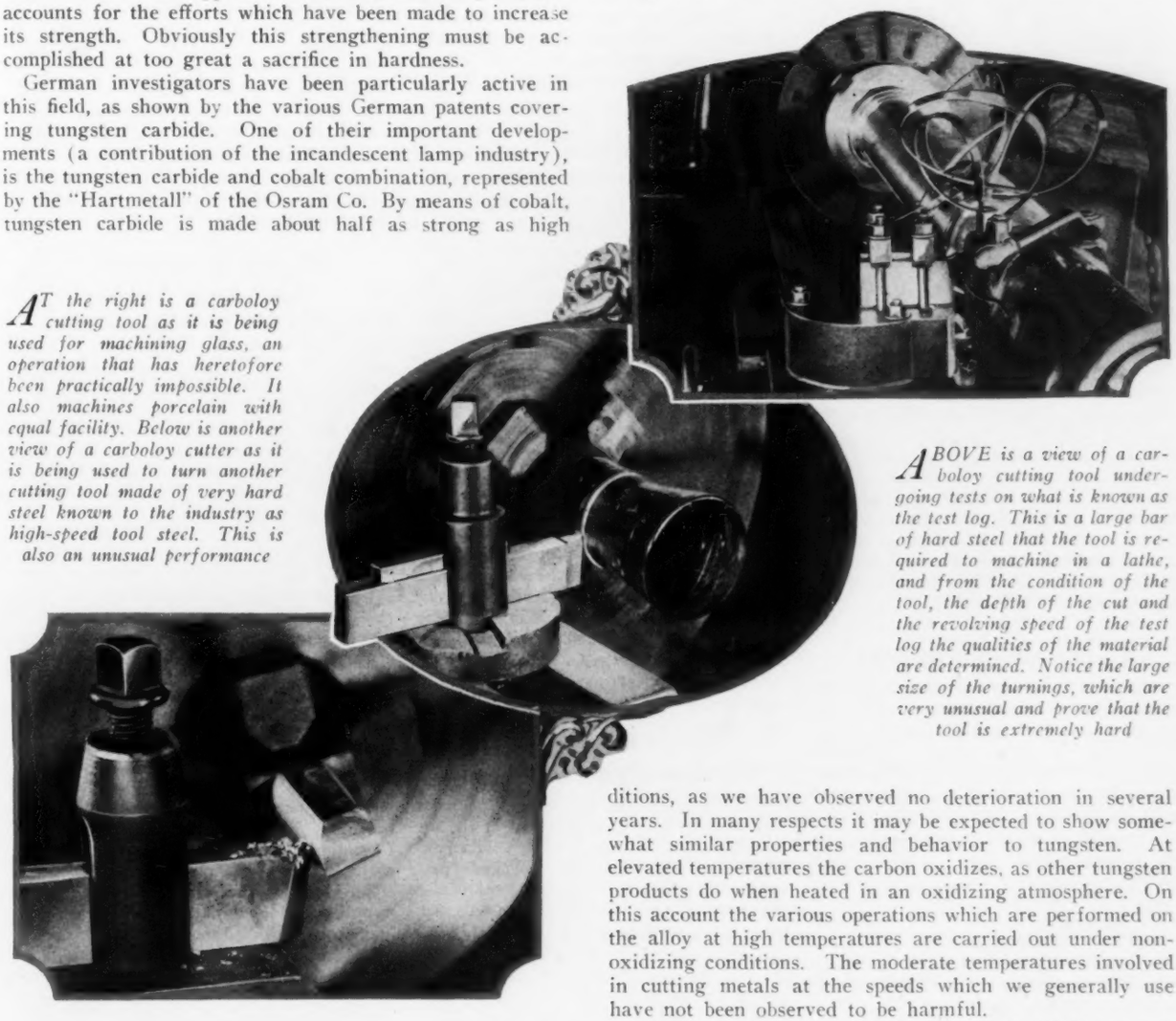
The density of this material runs 14 grams per cubic centimeter and above, depending on the amount of cobalt used. This characterizes it as a heavy metal, almost of the tungsten class. It does not tarnish and, when ground, resembles metals of the steel class in appearance. It resists chemical attack remarkably well and is a pleasing and satisfactory material for use in the arts.

Retains Hardness at High Temperatures

ITS hardness can be given in a number of ways. Sapphire is the mineral which comes next below the diamond in hardness. This new material is capable of producing a well-defined scratch in the natural sapphire. When it is borne in mind that the sapphire has an "absolute hardness" of 1150 kilograms per square millimeter, and that a mineral which is as hard as feldspar has an "absolute hardness" of 300, the hardness of this new material receives new significance.

The chemical stability of a new material is naturally of considerable interest. The material is probably permanently stable at room temperature and under normal conditions, as we have observed no deterioration in several years. In many respects it may be expected to show somewhat similar properties and behavior to tungsten. At elevated temperatures the carbon oxidizes, as other tungsten products do when heated in an oxidizing atmosphere. On this account the various operations which are performed on the alloy at high temperatures are carried out under non-oxidizing conditions. The moderate temperatures involved in cutting metals at the speeds which we generally use have not been observed to be harmful.

Finally, we have to consider the way in which the material retains its strength and hardness at elevated temperatures. No quantitative test data can be given at this time, but we know from the performance that the German material retains its hardness at a bright red heat to a most remarkable degree. Tools have been observed cutting nickel steel when the point is at this temperature, without showing any ill effects. The new tool material taking the same cut, operates at an appreciably lower temperature.



AT the right is a carboloy cutting tool as it is being used for machining glass, an operation that has heretofore been practically impossible. It also machines porcelain with equal facility. Below is another view of a carboloy cutter as it is being used to turn another cutting tool made of very hard steel known to the industry as high-speed tool steel. This is also an unusual performance

ABOVE is a view of a carboloy cutting tool undergoing tests on what is known as the test log. This is a large bar of hard steel that the tool is required to machine in a lathe, and from the condition of the tool, the depth of the cut and the revolving speed of the test log the qualities of the material are determined. Notice the large size of the turnings, which are very unusual and prove that the tool is extremely hard

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

Highlights of the Export Trade

As indicative of the importance of export business to industries of the United States the Bureau of Foreign and Domestic Commerce of the Department of Commerce points out that American industries did more foreign business in the first six months of 1928 than in any 12 months prior to 1916; that 53 of the 55 leading exports for the period were finished and semi-finished products; that our Canadian neighbors increased their purchases nearly 6½ per cent, buying $45.70 worth of American goods per capita for the six months, and that automobiles and parts amounted to 10 7/10 per cent of our total exports.

Utilization of Copper in the Electrical Industry

Copper to the amount of 3,000,000,000 pounds a year is now being utilized in the generation and use of electricity in the United States, according to the Copper and Brass Research Association, and this is exclusive of the use of copper for telegraph and telephone lines and for export equipment. In addition to the large amount used in the generation of electricity hundreds of thousands of pounds are required in telegraph, telephone and cable communication systems. In its statement the association points out that in one telephone system over 100,000,000 pounds of copper are used annually for new construction and replacements.

Conditions in Argentina

Business continues to be good, the United States Department of Commerce reports. The 1929 national budget shows an increase in expenditures of 55,000,000 paper pesos as compared with the previous year. The total foreign trade during the first eight months increased 5.6 per cent and imports 9.1 per cent, as compared with the corresponding period of 1927. The Government of the Province of Buenos Aires has authorized to call for bids for the construction of 110 school houses at a total cost of 12,000,000 paper pesos, and also authorized its Executive to spend 1,000,000 paper pesos for the construction of a branch provincial railway line connecting El Trigo with Las Flores.

Utility Service Expansion in Mexico

The American company supplying electric energy in San Luis Potosi was recently merged with another foreign company. The growing demand for power, sales of electric energy for power and light having more than doubled in the past three years, has caused the company to look for new sources of power and engineers are engaged in making studies and gathering data pertaining to a water power site known as "El Salto." This program of expansion and development will probably involve an expenditure of eight or ten million dollars, including erection of plant and construction of power lines to San Luis Potosi, and possibly to Charcas and Matehuala, where there are large mining and smelting operations, according to United States Consul William Wallace Early.

America Leads World in Zinc Stocks on Hand

Recent reports from the American Zinc Institute state that the world's stock of zinc as of July 1 totaled 64,200 metric tons, with the United States far in the lead with 40,300 metric tons. Belgium was second in position with 5200 metric tons; Canada third with 4500; Australia fourth with 4000; Germany-Poland fifth with 3800; France sixth with 1500, and Great Britain seventh with 1300 metric tons.

San Juan Hydroelectric Plants Destroyed

The electric company supplying current to San Juan and the northern part of the island lost its two hydroelectric plants near Comerio as a result of the recent storm and it is estimated that several months will be required to replace them, according to a report from United States Assistant Trade Commissioner J. R. McKey, San Juan. In the meantime the community is dependent on an auxiliary steam generating plant in San Juan.

Porcelain Electrical Supplies

The Department of Commerce announces that, according to data collected at the biennial census of manufacturers taken in 1928, the establishments engaged primarily in the manufacture of porcelain electrical supplies in 1927 reported, for that year, a total output valued at $22,871,610, of which amount $22,236,639 was contributed by porcelain electrical supplies (exclusive of the value of fittings) and $634,971 by miscellaneous products.

Conditions in Australia

Retail trade in Melbourne has improved considerably since the opening of the agricultural shows which featured American automobiles and other equipment imported from the United States. No substantial rains have been reported from wheat-growing areas during the past week. The wharf strike continues.

Nation's Electricity Bill

If the cost of electricity for home use had increased since 1913 in the same ratio as the cost of living, the average rate for 1928 would be more than 100 per cent greater than in 1913, instead of 15 per cent lower, as it actually is, according to the National Electrical Light Association. Estimated on the purchasing value of the dollar in 1913, this reduction in the cost of current is equivalent to 50 per cent. If the domestic rates had increased since 1913 proportionately as much as the cost of living has increased, it would have amounted to additional charges to the public of about $350,000,000 more last year than the amount actually collected by the electric light and power industry for this class of service.

Electric Refrigeration Cuts Dairy Costs

The New Hampshire Agricultural Experiment Station, as the result of a study conducted over a period of time, found that the average cost of the use of electric refrigeration on dairy farms was about half that of the natural ice method. Total refrigeration expense ranged from 67 to 140 per cent more when natural ice was used. On a total cost basis the average for all farms was:

	Natural Ice	*Electricity*
Cost per cow per year.....	$6.36	$3.17
Cost 100 qts. milk per year.	.30	.15
Cost per cu. ft. storage contents.....	1.32	.69
Cost per cu. ft. total contents.....	1.19	.62

Danish Police Consider Television

Danish police authorities are experimenting with radio equipment for the transmission of photographs and other information. Danish radio firms are assisting in this work and to date the results obtained have been very satisfactory. It has been possible to transmit in this way in three minutes' time a photograph to all police stations and all border passport stations in the country. It is expected that the installation of this kind of equipment will soon take place, according to United States Vice-Consul E. A. Johnson at Copenhagen.

Conditions in Canada

Cooler weather has stimulated a fresh impetus to trade, particularly in seasonal lines. Electrical appliances are said to be enjoying a good sale and an increasing demand is reported for radio equipment, heaters, weatherstripping and ammunition.

Putting Pep Into Sales Conventions

(*Continued from page* 175)

company holds conventions of this kind every year. The only difference is that they do not cost quite so much and there is a much smaller attendance.

Both the Frigidaire Company and the Hoover Company make their dealers and salesmen earn the right to attend the convention. A Frigidaire dealer has to attain a certain quota in order to get his expenses to the sales convention paid. The elimination contests which the Hoover Company stages throughout the year are apparently much more severe. Only star men gain the privilege of going to the big annual blow-out at North Canton. Out of the two or three thousand salesmen selling Hoovers, only about 250 men, or "Maximen," as they are called, qualify for the convention. Naturally their expenses are paid.

Most companies who have had a lot of experience in running sales conventions feel that it is impossible to handle more than 200 or 300 men properly. Hence, concerns that have much larger selling forces are inclined to break them up into district conventions or to eliminate all men who do not reach a certain standard.

It requires 140 persons to service the 250 attendants at a Hoover gathering. These include cooks, waiters, barbers, porters, etc. During the week of the convention, the company charters all the taxicabs in Canton. An elaborate tent city is put up on the convention grounds. Plumbing is installed in the tents. Thus, the men have all the bathing and toilet luxuries that they enjoy at home.

The first day of the convention a big parade is held. The company receives ideas for floats from its branches and departments months before the convention. All of these floats are constructed, no matter how costly the suggested design. The costumes worn in the parade cost a small fortune. The parade proceeds through the streets of North Canton and each year it draws people for miles around. A gigantic barbecue is given to which everyone is invited.

Each day of the convention a daily newspaper is published, giving all the news of the affair. Blimps and planes fly over the tent city and toss appropriate sales literature down to the men. On the last night of the convention a magnificent pageant is staged.

The Hoover convention lasts two weeks. The first week is for salesmen who qualify. The second week is for district managers and for any of their sales supervisors who qualify. Branch managers may attend both weeks.

It is frequently asked if it pays a manufacturer to go to such expense to hold a sales convention. The Hoover Company will tell you that it unquestionably does. A man who attends one of these gatherings is treated so royally that he becomes wildly enthusiastic about the concern he is working for. He goes back to his territory filled with energy. He communicates both his energy and his enthusiasm to his associates who were not fortunate enough to attend. They make up their mind to qualify for next year's show or to bust a suspender in trying.

Guiding Industry to Profit by the Facts

(*Continued from page* 160)

valuation of the traditional statistical measures of business activity.

In order to assist in the clarification of this issue and in a common agreement, the Board arranged two conferences on business statistics early this year. Representatives of trade organizations and business papers, business executives and authorities in the field of statistics and economics were brought together. While more conferences of this character will have to be held before definite results can be recorded, the preliminary conferences have helped to focus attention on the issue of business statistics, and their presentation, and have increased the desire for a reasonable agreement. It is intended to arrange other conferences on business statistics.

When, during the winter of 1927-1928, some unemployment became noticeable, various official and unofficial "estimates" of the number of unemployed in the United States were made, estimating the number of persons out of work as anywhere from two to eight millions. There is no question that the emphasis given to these estimates in the public press and in business discussion tended to increase the uncertainty felt at that time in many quarters regarding the immediate future of business conditions. The Board analyzed the estimates and pointed out publicly the fact that all such estimates were misleading, inasmuch as there are no statistical data available in the United States upon which a valid estimate of the number of unemployed persons can be made. The Board also, on the basis of its monthly study of wage earnings and of the number of hours worked in factories and of the number employed in manufacturing plants, gave assurance that at the very time that the public's attention was called to the fact of existing unemployment (in February), industrial activity was actually on the increase, and that the number of wage earners employed had been increasing since the first of the year. The subsequent noticeable recovery in business fully vindicated the Board's position.

The reports and other published data on industrial-economic affairs in possession of the Conference Board consulted by representatives of governments and industry, and by students of economic issues, both of the United States and of countries throughout the world, because they are recognized as authentic, and their impartiality has been attested to by representatives of labor as well as other groups.

Protect Your Pension System

(*Continued from page* 169)

maximum service is $150 per month. However, the income annuity added to the service annuity may increase the total retirement annuity beyond $150 per month.

The pension plan of the Willard Storage Battery Company of Cleveland, adopted in June, 1923, and amended in 1927, is similar to that in force in the General Electric Co. with some exceptions:

Eligibility of male employees—(a) 25 years or more in service and have reached age of 70; (b) 30 or more years in service and have reached age of 65; (c) 30 or more years in service and have reached age of 60.

Eligibility of female employees—Same as male except age is (a) 60; (b) 60.

How computed—(1) number of years in service; (2) amount of employee's yearly earnings for the 10 consecutive years of highest earnings, including all salary, wages, and bonus, divided by ten.

Pension allowance to be paid as computed by multiplying 1/12 of 1½ per cent of the average yearly earnings by the number of years in service. The Westinghouse Electric & Manufacturing Company pension system was adopted January 1, 1915, and revised Feb. 1, 1922. It requires 20 or more years of service on retirement at 70 years. Service pensions are computed by taking one per cent of average monthly wages for last ten years of service, and it is similar to General Electric pension plan.

The reason for failure of numerous pension systems to operate successfully and a suggestion for the true basis and correct principles of such plans will be obvious if we isolate the case of a single pensioner, who, we will assume, has been in the employment of a company for 30 years, and has reached the age of 65 years. If an agreement has been negotiated with an insurance company to carry the pension payments after the date of this employee's retirement, the agreement has been worked out by the computation of annuities. In other words, it would be necessary to determine what annual premium must be paid from the date of agreement, say 30 years before the expiration of the pension qualification period, fixed by the insurance company after computing the average life expectancy and the compound interest earned by the premiums during 30 years. Now if the corporation wishes to put into effect a dependable pension plan, it must proceed along lines exactly analogous to those followed by the insurance company. An amount must be estimated for annual appropriation by way of reverse (corresponding to the premium), which, compounded, will carry the pensioner from the time of his retirement until his death. The most important element contributing to the solution of the problem is the interest. Analysis will demonstrate that for every dollar appropriated by the corporation as reserve, almost two dollars will be earned by compounded interest. This plan has the advantage of flexibility in respect to fluctuations in payroll, since an increased annual appropriation corresponding to the increase in payroll may be made at any time.

In view of the general lack of appreciation among the industrial executives of the ultimate cost of pension plans, it may be of interest to offer some observations, based partly upon the limited American experience and partly upon the longer European record.

1. The total pension cost for any one year will not reach a maximum until the youngest employee at the time of the beginning of the plan reaches an extreme old age. In other words, the annual cost, apart from any increase in the number of employees, will show a continued increase for some 60 or more years after the origin of the plan. This is due partly to the longer service records of the younger men who eventually reach the retirement age, and partly to the effect of higher wage scales as the business grows.

2. At the maximum, the pension cost will be about 10 per cent of the annual payroll, assuming that present tendencies in the rate of turnover will continue. Some municipal pension funds which have been in operation a long time require an annual appropriation in excess of 20 per cent of the current salary list. The present experience of American pension plans, whereby a yearly appropriation of about one per cent of the annual payroll is adequate to meet current requirements, will most certainly prove an unreliable criterion in the future.

3. An annual appropriation of one per cent of the payroll will probably prove sufficient to pay all current pensions and provide an adequate fund for the future, including allowance for growth in number of employees and wage increase, if it is made effective when the business begins. But as most pension plans are started after the concern has been in existence a certain period, the one per cent appropriation takes care of the present and future only. The accrued liabilities of the past must also be taken into consideration if the reserve fund is to start on a solvent basis. An initial reserve appropriation of about 50 per cent of the current annual payroll will be necessary for this purpose.

4. An annual appropriation of about 2¾ per cent of the payroll is a fair estimate of what is necessary to meet current pension requirements and build up a fund for future needs in the case of companies which have been established for many years.

In the first place, a comprehensive analytical survey by an actuary or statistician is necessary to determine the rate of increases in pension liabilities from the beginning of the pension qualification period to the date of inception of the plan. This rate must be projected into the future to determine the approximate rate of prospective increase. The first years that a pension plan is operated show a comparatively low pension cost relative to the amount of payroll. As the pension plan is applied year after year, the increase in numbers of employees qualifying for the position is relatively much greater than the increases in payroll. It is apparent that provisions must be made at the inception of the plan for taking care of this increase in the number of pensioners. Various plans have been suggested but none of them, excepting those which have been prepared in accordance with insurance methods, have been effective.

In order to devise an accurate, mathematically scientific system for a group, it is necessary to consider the factors of labor turnover and life expectancy at the age of retirement, in the light of the insurance mortuary tables. Although it is impossible to figure turnover with a degree of certainty that could be relied upon in respect to mortality percentages, a company during the first year of existence should establish the practice of setting aside a sufficient pension reserve and of permitting it to increase at compound interest to provide for all eventualities, including turnover.

If a corporation, through lack of understanding of sound pension procedure, has got into deep waters, it will at least be possible to apply correct principles in the development of a new or revised plan. Usually a three phase problem is presented, embracing qualified pensioners, those employees whose qualification periods are in process, and employees who will qualify in the future.

Electrical Manufacturing News

A department containing news and descriptions of new materials, parts, devices and special tools for the manufacture and repair of electrical products

International Congress on Illumination Closes

The first International Illumination Congress, attended by delegates from France, Great Britain, Germany, Austria, Holland, Japan, Sweden, Switzerland, Brazil and United States, was held Sept. 22-28 at Saranac Inn, N. Y. Leading experts in specialized work contributed their knowledge and experience to the deliberations of the seventh meeting of the International Commission on Illumination, which constituted the final part of the Congress. The first part was taken up by a tour of eastern cities, where outstanding developments in the illuminating engineering field were studied, and the second was participation in the twenty-second annual convention of the Illuminating Engineering Society at Toronto, Sept. 17-20.

Safer highways for the world was the object of two sessions covering street lighting and automobile headlights. The subject of safe airplane landings on unlighted fields was discussed, as well as better lighting conditions for factories and schools.

Prominent delegates included: Dr. Clifford C. Patterson, president; P. Good, L. B. W. Jolley, Dr. L. W. T. Walsh and R. R. Watson, Great Britain; Prof. J. Chappuis, A. Gouffe, H. Maisoneuve and R. de Valbreuse, France; Dr. N. A. Habertsma, Holland; Dr. J. Adolph, Dr. L. Bloch, Dr. H. Meyer, L. Schneider and W. Wiseman, Germany; Dr. E. Bausenwein and H. Schlogl, Austria; Dr. Toru Motono, Japan; H. A. J. Henke, Sweden; E. Payot and A. Filliol, Switzerland; H. de B. Pereira, Brazil; John W. Lieb, Norman Macbeth, Preston D. Miller, Dr. Clayton Sharp, A. L. Powell, W. D'A. Ryan and G. H. Stickney, United States.

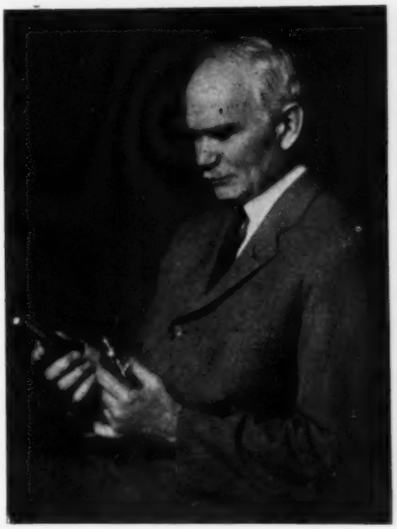
Battery Manufacturers Choose New Officers

At the sixth annual session of the National Battery Manufacturers Association, Sept. 20 and 21, at Ambassador Hotel, Atlantic City, D. H. Kelly, retiring president, sketched the development of the battery business and declared that, despite the drop business took after the war, the battery industry was on an excellent basis now. He believed it was the excellent cooperative spirit among battery men that raised the battery business to its present plane.

Other speakers included W. J. Parker, commissioner of the association; G. M. McGraham, vice-president of Willys-Overland Company, and J. B. Perlman of the Hartford Battery Manufacturing Company. These officers were elected: Ward S. Perry, president; J. B. Perlman, first vice-president; A. A. McLean, second vice-president; Paul M. Marko, treasurer; E. C. Handler, secretary; L. A. Doughty, director; A. J. Baracree, director, and W. J. Parker, commissioner.

Three Prominent Directors Added to De Forest Board

De Forest Radio Company has added to its board of directors Powel Crosley, Jr., president, Crosley Radio Corporation, Cincinnati, Vincent Bendix, president, Bendix Corporation, South Bend, Ind., and Chauncey P. Anderson of the law firm of Pendleton, Anderson, Iselin & Riggs, New York City.



Dr. Lee De Forest

Mr. Garside, president, reports progress in re-equipping the company's large plant in Jersey City and in securing the engineering and production personnel, as well as building up an efficient business and sales organization. The plans for the year, which include steadily increasing production until an annual vacuum tube output of 5,000,000 is attained, have received the full approval of the stockholders.

Otterson Addresses League on Talking Motion Pictures

At the monthly luncheon of the New York Electrical League, Sept. 26 at Hotel Astor, John E. Otterson, president of Electrical Research Products Corporation, discussed the development and future of talking motion pictures. He stressed the fact that not only had "audible cinema" revolutionized the movies from an amusement standpoint, but that their future value as an educational instrument would be greatly enhanced.

Mr. Otterson traced the growth of talking pictures and declared their perfection was directly dependent on the perfection of the telephone. He estimated that by the end of 1929 at least 3000 theaters throughout the United States would be equipped with apparatus for projecting talking pictures. The luncheon was brought to a close with an interesting practical demonstration of the entertaining values of talking pictures.

Radio Manufacturers Announce Removal

Expansion of the Radio Manufacturers Association and its service has made necessary larger quarters in New York for its eastern headquarters. The offices are now located in the Salmon Tower, room 1390, 11 West 42nd Street, New York.

The National Association of Broadcasters has removed its offices from 1265 Broadway to the Salmon Tower Building.

Commerce Department Offers Foreign Construction Data

Advance information regarding construction projects in foreign countries is now being made available in a weekly bulletin issued by the Department of Commerce, Washington. In this bulletin details are given as far in advance as possible concerning dwellings, hotels, hospitals, theaters, sanitary works, railway, bridge and tunnel projects, harbor improvements, hydro-electric works and other important construction work being contemplated abroad. "Foreign Construction News Supplement" is issued without charge and may be obtained from W. H. Rastall, Chief, Industrial Machinery Division, Department of Commerce, Washington, D. C.

S. E. D. Elects Directors at Annual Meeting

Election of directors of the one-year and three-year classes was the chief business at the annual meeting of The Society for Electrical Development, Inc., held recently in New York City. The following directors were elected:

Central station, P. S. Arkwright, M. E. Sampsell, P. S. Clapp, J. F. Gilchrist; manufacturer, H. B. Crouse, A. E. Waller, F. R. Farmer, Gerard Swope; wholesaler, G. E. Cullinan, E. Donald Tolles, F. S. Price, W. W. Williamson; contractor-dealer, C. L. Chamblin, L. W. Davis, C. M. Beltzhoover, J. F. Burns; local electrical leagues, R. B. Corcoran, H. A. Brookes, J. E. North, E. M. Ashworth, R. A. Gordon; at large, F. D. Gill.

Messrs. Gilchrist, Farmer, Williamson, Burns and Ashworth were elected for three years, all others for one year.

P. A. Terrell Associated with Copperweld Steel

Copperweld Steel Co., 215 N. Michigan Ave., Chicago, announces that P. A. Terrell, formerly manager of the new industries division of the Mississippi Power Company, is now in charge of central stations and railroad sales.

P. A. Terrell

Mr. Terrell graduated from Alabama Polytechnic Institute in 1917. He spent nine years on the General Electric test course at Schenectady. Following service in the war, he was employed by the Alabama Power Company in the line and maintenance department. In 1921 he became superintendent of the Gadsden division, and in 1922 district manager of the Jasper division. He resigned that position in 1927 to become associated with the Mississippi Power Company.

Radio Engineers Award Liebmann Prize to Cady

The board of directors of the Institute of Radio Engineers voted to award the Morris Liebmann memorial prize for 1928 to Prof. W. G. Cady, head of the department of physics at Wesleyan University, for his research in the field of piezo-electric phenomena. The award, which was announced by Dr. A. N. Goldsmith, president of the Institute, will be presented to Professor Cady in November.

A technical paper describing applications of piezo crystals to the new screen-grid tubes by one of Professor Cady's associates, J. R. Harrison, was read.

Prominent Author to Write Television Article Series

R. P. Clarkson, author of several articles on television and radio which have appeared in Electrical Record, and also author of "The Hysterical Background of Radio," has been selected by the Radio Manufacturers Association to write a series of articles which will advise the public regarding the present status of television and its future possibilities. The association intends that these articles, by telling the truth about television, will offset premature publicity which may tend to create sales resistance against audio receivers.

Probably no author has been in closer touch with the development of television, as well as aural radio, than Mr. Clarkson. His technical and popular articles have been appearing in prominent trade journals and other publications for a number of years.

Westinghouse Mill Motor Sent to India Steel Co.

Tata Iron & Steel Company, Jamshedpur, India, recently purchased a 4600 hp., 0-50-120 r.p.m. reversing mill motor from Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A flywheel set accompanying the motor provides the power and consists of two 1900 kw. generators, one 75,000 lb. flywheel and one 3500 hp. induction motor, all operating on the same shaft at 500 r.p.m. A liquid slip regulator controls the load on the flywheel set.

The motor will be used on a 36 in. roughing mill, for rolling rail and structural shapes.

Cooking Conference Held at Westinghouse Plant

The N. E. L. A. division of commercial cooking recently held a commercial cooking conference and sales school in Mansfield, Ohio, at the heat appliance plant of the Westinghouse Electric & Manufacturing Company. The course, Sept. 20-22, supplemented one held in Chicago Sept. 18-20 by the Edison Electric Appliance Company.

Lauds Radio as Strong Americanizing Factor

Returning from an 18,000-mile trip through leading cities in the United States, Canada and Mexico, Sayre M. Ramsdell, manager, sales promotion, Philadelphia Storage Battery Co., declared that radio has developed into a power comparable to that of the American public school system. He pointed out that in breaking down sectional barriers, radio had done more toward Americanizing the foreign population than all the books written along that line. Mr. Ramsdell expressed the opinion that 1928 would prove to be the greatest radio year in history.

A Trio of Globe Trotters

At the left is Sayre M. Ramsdell, manager sales promotion, Philadelphia Storage Battery Company, who just returned from an extensive tour of North America. With him are shown Harry Boyd Brown and Robert F. Herr

Rainbow Light Opens Plants in Pittsburgh and Boston

Rainbow Light, Inc., manufacturer of luminous tube electric display and operating subsidiary of Rainbow Luminous Products, Inc., has opened two production plants, in Pittsburgh and Boston, to handle increased business and to relieve the Detroit and Long Island City plants, formerly serving those areas, according to E. C. Bull, president.

The capacity of the Detroit plant is being enlarged, also the main plant at Long Island City.

Sherman Company Announces Election of New Officers

Allen H. Warner, vice-president and general manager of the H. B. Sherman Manufacturing Company, Battle Creek, Mich., has been elevated to the presidency, left vacant by the death of Howard B. Sherman.

Mr. Warner first associated himself with the company more than 17 years ago as a traveling salesman. In 1912 he was called to the factory in Battle Creek to assume the position of sales manager. Six years later he was elected a vice-president and gradually assumed increased responsibilities under the direction of Mr. Sherman.

Allen H. Warner

Donald P. Ordway, a director for several years, is now a vice-president. He was the personal representative on the Board of Mr. Sherman. George E. Townshend has been chosen secretary and treasurer.

Annual Credit Convention to Be Held in Chicago

A record attendance is expected at the thirty-third annual convention of the Central Division of the National Electrical Credit Association, which will be held at the Palmer House, Chicago, Nov. 22-23. Preparations for the celebration of a third of a century of service of this mutual cooperative organization indicate that this will be a most enthusiastic function.

Committees are at work preparing for

the many important matters that are to be considered. Delegates will be present from the states from Ohio to Colorado, Minnesota to Texas, and from Louisiana and Florida.

R. M. A. Television Committee Appoints Replogle Head

D. E. Replogle, engineer of the Raytheon Manufacturing Company, Cambridge, Mass., has accepted the chairmanship of the committee on television standards of the Radio Manufacturers Association. This committee was formed for the purpose of studying the wide range of television practice confronting the radio industry, the nondescript collection of components and the loose and often meaningless terms used in describing television systems.

The committee plans to adopt certain television standards and terms in bringing definite order out of the present experimental chaos. Standards are to be worked on for such features as scanning discs, neon tubes, disc speeds and photo-electric cells.

Radio Stations to Comply With Reallocation Orders

Latest developments in the situation surrounding the Federal Radio Commission reallocation orders reveal that few, if any, broadcasters will protest the new wave length assignments which go into effect Nov. 11. Most station managers are complying with the Commission's order authorizing stations to test after midnight on their new wave lengths.

Many stations have already ordered their new crystal wave meters or control apparatus to keep the station from straying from the new waves when the changes become effective. Only a few of the smaller stations have indicated their intention of ignoring the Commission request that tests be made.

Pioneer Edison Associate Dies in Jersey at 85

Isaac Krall, for many years associated with Thomas A. Edison, died at his home in Clinton, N. J., Sept. 29, after a long illness. He was born in Pennsylvania 85 years ago and served in the Civil War.

In 1899 he joined Edison's forces and became chief engineer of the Pearl Street power station in New York. He remained with the Edison company actively until he purchased the Perry mill in Clinton, which he directed. At the luncheon of the Edison Pioneers at the Hotel Astor, New York, last January, he was the oldest Edison pioneer present.

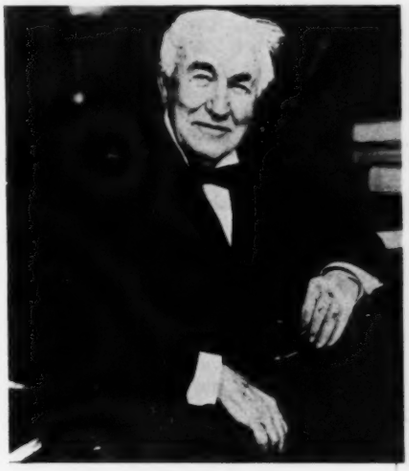
Fire Protection Conference Convenes in New York Soon

In accordance with the instructions of the executive committee of the National Fire Protection Association, a conference will be held Nov. 15 and 16 in the auditorium of the Consolidated Gas Company, 130 East 15th Street, New York City. At the sessions, over which A. E. Small, chairman of the electrical committee, will preside, the whole subject of grounding of equipment and appliances in interior wiring systems, including methods of grounding by means of auxiliary conductors, what fixed equipment should be grounded and whether portables in domestic establishments need be grounded, and if so how, is to be discussed. As a result of the conference, a special report is to be given to the meeting of the electrical committee in February, for appropriate action.

Design Approved for Medal to Be Presented to Edison

According to an announcement from the Treasury Department, Secretary Mellon has approved the design for the gold medal to be presented to Thomas A. Edison October 20 at Orange, N. J. The medal is now being prepared at the U. S. mint in Philadelphia.

The Secretary of the Treasury was



Thomas A. Edison

authorized to fashion and present a medal to Mr. Edison under a resolution passed by Congress May 28, 1928. The design approved was executed by John R. Sinnock of Philadelphia and the approval was concurred in by the Commissioner of Fine Arts.

Formal presentation of the medal will be made in Mr. Edison's laboratory at West Orange, N. J. Preceding the ceremonies will be a short address by President Coolidge over a nation-wide hook-up of radio stations. The presentation will be made by Secretary Mellon.

Electric Heating Featured at Welding Society Meeting

Exhibits of industrial electric heating, electric welding and temperature control equipment were important features at the combined convention of the American Welding Society, the American Society for Steel Treating, and the American Institute of Mining and Metallurgical Engineers held in Philadelphia, October 8-12. Manufacturers of industrial electric furnaces and related control equipment had extensive exhibits showing the application of their apparatus.

Electric Arc Welding Talks Planned by Prof. McKibben

In response to invitations from various societies throughout the country, Prof. Frank P. McKibben, consulting structural and bridge engineer, will shortly start a series of lectures covering a large part of the United States.

The lectures during the winter months will be on the application of electric arc welding to the noiseless construction of building, based on the experience of the General Electric Company and other pioneers in this field. General Electric has already erected one large building and a few smaller ones by this method, and a number of other structures are now being welded by different companies.

Trades Association Discusses Apprentice Training Value

The practical advantage to the manufacturer of training apprentices were stressed by C. S. Thompson, chief engineer of the Union Special Machine Company, Chicago, at the annual apprenticeship dinner of the National Metal Trades Association at Milwaukee, September 24. Mr. Thomson pointed out that his organization has built up its personnel from graduates of shop apprentice courses. About 145 representatives of metal trade shops attended the dinner.

W. J. Fairbairn, secretary, Milwaukee section of the association, indicated that in the course of the last six years the number of apprentices in his district had increased from 450 to 1,000. He showed that the majority of apprentice graduates remained at the trade in which they had been instructed. He also said that in view of the fact that shops where apprenticeship is established had a smaller turnover than other shops, apprenticeship appeared to have a beneficial effect on labor turnover.

Youngstown Steel Takes Over Bonnell Conduit Sales

Youngstown Steel Products Company, Youngstown, Ohio, a subsidiary of Youngstown Sheet and Tube Company, announces that W. A. Bonnell, of Bonnell Electric Manufacturing Company, has retired from the conduit business in order to devote more time to his own business. In the future, the conduit business formerly handled by Mr. Bonnell will be handled through Youngstown Steel Products.

The product known as Buckeye conduit, which the Bonnell Company has been selling for many years, will be in charge of T. C. Ringgold, formerly associated with the Bonnell Company, who will be located at 30 Church Street, New York City.

Two Divisions of National Lamp Works Are Consolidated

The Midland and Federal divisions of National Lamp Works of General Electric Company have been consolidated, personnel of both organizations being

retained. The combined organizations will operate under the name National Lamp Works of General Electric Company, Midland-Federal Division. A. H. Meyer, formerly general manager of the Midland division, has been appointed general manager in charge of operation. H. D. Laidley, formerly general manager of the Federal division, has been appointed assistant general manager in charge of sales.

New Corporation Is Formed by Timken Roller Bearing

Timken Roller Bearing Company has incorporated the Timken Steel & Tube Company to take over the manufacture and sale of steel and tubing. Headquarters and mills are in Canton, Ohio, with sales offices in Chicago, Los Angeles, Detroit and New York. The officers are: H. H. Timken, chairman; M. T. Lothrop, president; J. W. Spray, vice-president; A. J. Sanford, vice-president in charge of sales; J. E. Daily, vice-president in charge of operations, and J. F. Strough, secretary and treasurer.

Brevities

Donner Steel Company, Buffalo, N.Y., has ordered three more 300 hp. oil-electric locomotives to be built jointly by the Ingersoll-Rand Company, New York City, General Electric Company, and American Locomotive Company. The company already has one of these units in operation.

Doehler Die Casting Company, New York City, has purchased the permanent mold casting equipment, dies, molds, and other relative tools of the Metal Mold Castings Company, Buffalo, N. Y., and will add these facilities to its permanent mold department. Metal Mold Castings Company ceases business.

Hubbard and Company, manufacturer of pole-line hardware and Pierce construction specialties, with factories located in Pittsburgh, Youngstown, Ohio. and Oakland, California, has purchased the pole-line hardware department of the Truscon Steel Company, Youngstown, Ohio. All operations, as well as stock at Youngstown, will be absorbed by the Pittsburgh plant of the Hubbard Company.

Stuart-Kay Company, formerly Scott-Ullman Company, announces removal of factory and offices from 3311 Perkins Avenue to 2480 East 42nd Street, Cleveland, Ohio. Harry O. Stuart is president of the new organization and Vernon G. Kay is secretary and treasurer.

Wagner Electric Corporation, St. Louis, announces the addition of R. W. Piper to its transformer sales division. He will travel the district including a section of West Virginia and the states of Virginia, North Carolina, South Carolina, Alabama, and Florida. D. H. Epting has been tranferred from the Philadelphia sales office to the Atlanta sales office.

Copeland Products, Inc., manufacturer of electric refrigeration, has announced the results of a nation-wide sales contest. The ten prize-winning cities are: Los Angeles; Boston; Springfield, Mass.; Oklahoma City; Milwaukee; Akron, Ohio; Youngstown, Ohio; Memphis; Madison, Wis., and Spartanburg, S. C. A special contest among teams sponsored by company executives was won by that of W. E. McElhinny, vice-president.

Ideal Commutator Dresser Company announces representation in New England territories by Albert E. Mace Company, Inc., 93-97 Heath Street, Boston, for the sale of commutators and motor maintenance products.

Meginnis & Company, Inc., is the new name of Morton Havens, Jr., Inc. E. E. Brubaker is vice-president of the new corporation, located at 368 Broadway on Plaza, Albany, N. Y. The company specializes in electrical construction and engineering.

Allied Engineering Company, Inc., announces that Alfred A. Wohlauer, founder and for many years president of the company, retired from active management on September 1. He will devote all time to engineering matters, being retained by Allied in a consulting capacity. He will be succeeded by Charles Byron Saxon.

Schneider Brothers, Inc., 304 N. Sheldon St., Chicago, announce new facilities for bakelite molding service.

Woodard Engineering Company, Fort Wayne, Ind., is the new name and address of Tri-State Engineering Company, Zanesville, Ohio.

American Brown Boveri Electric Corporation has purchased the transformer division, Packard Electric Company, Warren, Ohio.

Holyoke Company, 621 Broadway, New York City, has purchased the De Luxe Manufacturing Company.

Richards and Company, Inc., Stamford, Conn., owners of the Zapon Company, announce acquisition of the Duratex Corporation, Newark, N. J.

Airmaster Corporation is the new name for Sinclair Equipment Corporation, with offices at 140 S. Dearborn St., Chicago. Plant of the company is located at Wells and Illinois Streets.

Personals

R. F. Frenger, former automatic switching sales head for Westinghouse Electric and Manufacturing Company, has taken over panelboard and theater switchboard sales for the company, with headquarters at Brooklyn, N. Y. Mr. Frenger served in the naval air corps during the war and upon his discharge in 1919 he reentered the employ of Westinghouse as a central station salesman in the Chicago and Minneapolis offices. Early in 1920 he associated himself with the Bascom-French Company, Las Cruces, New Mexico, but after a brief period returned to the switchboard sales department of Westinghouse.

Charles Hoffman has been named southwest representative of the Belden Manufacturing Company, manufacturer of insulated wire and cables, 2300 South Western Avenue, Chicago. He will cover western Missouri, Kansas, Nebraska and Colorado, with offices in the City Bank Building, St. Louis.

E. C. Minteer, who has been associated with Railway and Industrial Engineering Company, Greensburg, Pa., since 1926, has been appointed district manager of the Chicago territory, with offices at 1843 Illinois Merchants Bank Building, Chicago. Mr. Minteer previously represented Westinghouse Electric and Manufacturing Company in the same section.

J. M. Bryant, professor of electrical engineering at the University of Texas, has resigned to become professor of electrical engineering and head of that department at the University of Minnesota.

Catalogs and Bulletins

Ideal Electric & Manufacturing Company, Mansfield, Ohio, Bulletin No. 501, flywheel effect for air compressors based on Ideal synchronous motor drive.

Electric Machinery Manufacturing Company, Minneapolis, Minn., Bulletin, synchronous motors.

American Manganese Steel Company, 333 North Michigan Avenue, Chicago, pamphlet, manganese steel.

Campbell Fibre Company, Stanton, Del., Bulletin, punch stock for insulating and fabricating purposes and panel stock for radio panels.

Louis Allis Company, Milwaukee, Wis., Bulletin No. 507, direct current motors.

Whiting Corp., Harvey, Ill., Bulletin, announcing series of technical articles on cast iron.

Stanley P. Rockwell Company, 66 Trumbull Street, Hartford, Conn., Bulletin No. 2808, heat-treating equipment.

Peck, Stow & Wilcox Company, Southington, Conn., circular descriptive of universal combination rotary machine.

Oster Manufacturing Company, Cleveland, Ohio, booklet, pipe threading and cutting machines.

Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Catalog No. 80, resistance thermometers.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., manual for training arc-welding operators.

Falk Corp., Milwaukee, Wis., Bulletin No. 180, flexible couplings.

Reliance Electric & Engineering Company, 1042 Ivanhoe Avenue, Cleveland, Ohio, Bulletin No. 103, fully-inclosed, fan-cooled induction motor.

American Society for Testing Materials, 1315 Spruce Street, Philadelphia, methods for tests relating to electrical insulating materials.

Coming Conventions

American Institute of Electrical Engineers.—Annual winter convention at New York City, Jan. 28-Feb. 1, 1929.

American Society of Refrigerating Engineers.—Meeting at New York City, Dec. 3-5.

National Association of Practical Refrigerating Engineers.—Meeting at Louisville, Ky., Nov. 20-23.

National Electrical Credit Association.—Annual meeting of central division at Chicago, Nov. 15-16.

National Electrical Manufacturers Association.—Meeting of Apparatus Division at Briarcliff, N. Y., Oct. 29-Nov. 1.

New York Electrical Credit Association.—Annual meeting at New York City, Dec. 11.

Obituaries

George C. Webber, assistant sales manager of the American Engineering Company, Philadelphia, died at his home in that city, October 1. Mr. Webber, who was 37 years of age, had been associated with the American Engineering Company and its predecessor, the American Ship Windlass Company, for more than 17 years, having entered the employ of the latter company in Providence, R. I., in 1911.

Leonard S. Tyler, vice-president of the Acme Wire Company, died at his home in New Haven, Conn., September 24, following an extended illness. Mr. Tyler had been connected with the Acme Company for 18 years, starting as assistant to the treasurer and rising to the position of vice-president. He was also vice-president and a director of the National Electric Condenser Company, New Haven.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York City.

"L. R. Co." Receptacles.
"Splendida" Electric Iron.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Wharton" Battery Charger.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.

Address of Dura Electric Appliances (Manufacturers of Curling Irons).

Patrician Line of Lighting Fixtures, asked for in our September issue, is manufactured by Patrician Art Metal Corp., 229 E. Maryland St., Indianapolis, Ind.

New Goods for Your Inspection

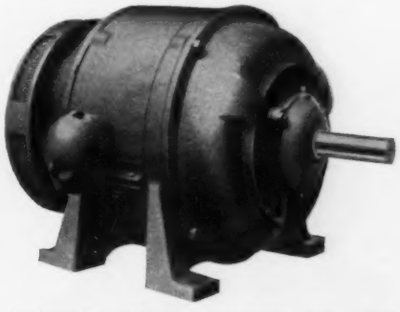
Television Clarostat

Clarostat Mfg. Co., 285 N. Sixth St., Brooklyn, N. Y., has brought out the television Clarostat, a special power type Clarostat together with a short-circuiting push-button, contained in a ventilated metal housing. The device has a resistance range of 25 to 500 ohms and dissipates up to 80 watts. It can be used for

controlling either a universal or condenser type motor, on A.C. or D.C., up to ⅛ hp. In actual operation the scanning disc is adjusted to the required speed by means of the large knob, after which the push-button is used for momentary acceleration in synchronizing the holes and the disc speed. The push-button is also used for quick starting. It is fitted with screw mounting brackets.

Fan-Cooled Motors

Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, has placed on the market Type AA line of fully-inclosed, fan-cooled induction motors. These motors are provided with ball bearings in dust-tight mountings, which are



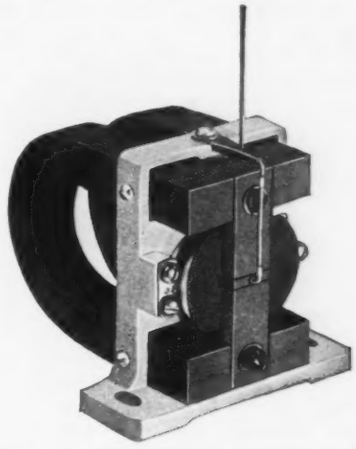
designed to reduce maintenance cost. Two kinds of construction are used. One for the smaller sizes is of the riveted-type frame, and the other for the larger sizes is the skeleton-type frame. In the riveted-frame motors internal fans are used to circulate the air around the coil heads. The single exhaust-type fan is used with skeleton-frame motors, the fan being mounted on an extension of the shaft outside of the front bearing bracket. These motors are available in sizes of ¼ to 40 hp. for operation on 220, 440 and 550 volts, 2 or 3 phase, 60 cycles.

Core Solder

Firth Radio Corp., 25 Beaver St., New York, is marketing a core solder which is designed to make perfect contacts without leakage and is non-acid and non-corrosive. This solder, which will be known as Firth core solder, is made in 1, 1½, 2 and 3 mm. sizes.

Loud Speaker Element

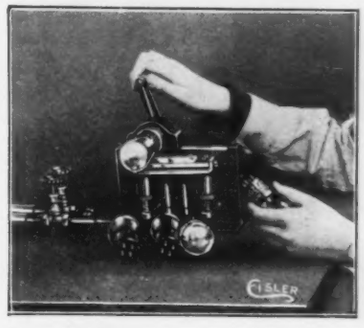
Duo-Magnetic Co., 215 Fulton St., New York, has placed on the market a loud speaker unit employing two large permanent magnets in a tandem arrangement and using two specially designed armature coils, which have non-resonant character-



istics. Parallel connection of the coil units is used to obtain maximum flux density and match the output impedance of power tubes. It is designed to produce even amplification.

Base Branding Machine

Eisler Engineering Co., 756 South 13th St., Newark, N. J., has brought out the Eisler base branding machine for branding the trade mark, type of tube or name of the manufacturer into the Bakelite base of tubes. The stencil block, which is made of chrome-nickel steel and heated by two small burners, gives the base a clean-



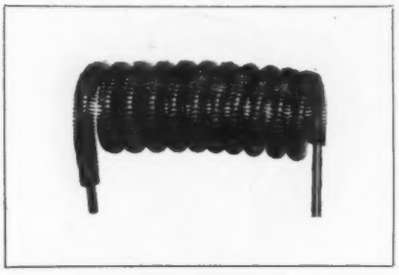
cut brand. The depth of the impression is regulated by means of two adjustment nuts, one at each end of the stencil block. The machine weighs ten pounds and requires twenty-five square inches of bench space. The amount of production depends on the skill of the operator, but the manufacturer states that 3500 a day is an approximate output.

Marsene Color Screens

Marsene Transparent Paper Corp., 1926 W. Tenth Ave., Gary, Ind., is marketing Marsene color screens. The manufacturer states that these screens have an advantage over the old gelatin plate screens in that they do not buckle and crack due to unevenness and have unusual pliability and texture that assist them to stand up under severe abuse. The life of the screen is designed to be considerably longer than gelatine plate screens, because they tend to readjust themselves after the light is turned off. Both plain and diffusing screens are available.

McCord Condenser Coil

McCord Radiator & Mfg. Co., Detroit, has placed on the market Type B spiral fin continuous coil for use in electric refrigerator condensers. The tubes are



wound with a continuous corrugated spiral fin, as this construction gives greater metal to metal contact and a more even distribution of radiating surface. Either brass, copper or steel tubing—hard or soft temper—can be supplied.

A. C. Automatic Starters

Industrial Controller Co., Milwaukee, announces the addition to its line of automatic motor control switches of a series of A.C. automatic starters, which will be known as Classes 8526 and 8536 (50 am-

pere size). Besides providing low voltage and either magnetic or thermal overload protection, these switches have new type detachable contact fingers, heavy magnet coil which provides unusual sealing pressure and self-aligning bearings and bronze bushings to reduce wear and insure longer life. They will supersede the Classes 8527 and 8537. The switches are available with push button in cover, without push button and with a three point switch in cover.

Totally Inclosed Motors

Cleveland Electric Motor Co., Cleveland, announces a totally-inclosed, fan-cooled type of motor. The end-covers of this motor are open, thus permitting free air circulation through the motor. The windings are protected by an inclosing jacket of stamped copper having a run-

ning clearance hole at either end to permit the shaft to pass through it. The Security ball-bearing type motor is designed to eliminate the possibility of any dust-leakage along the shaft into the windings. The fan is mounted at the end away from the motor pulley, between the inner and outer end-covers.

Single-Phase Motors

General Electric Co., Schenectady, N. Y., announces a single-phase, repulsion induction motor, in sizes including ¾, 1, 1½ and 2 hp. at 1800 r.p.m. It is of the constant-speed, high-starting torque type for general application. The motor is inclosed except for ventilating openings in the lower portions of each end shield. Air is drawn through the ventilating openings

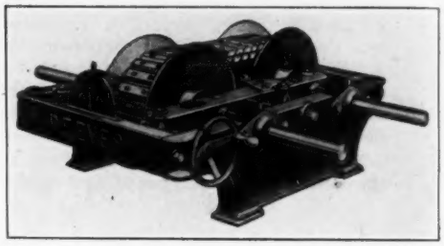
at the pulley end by means of an internal fan. It then passes around the stator laminations and out through the ventilating openings in the commutator end. One of the most important improvements is the more efficient use of the stator punchings, which is accomplished by taking full advantage of the design possibilities of the polar winding of a repulsion motor.

Cromovan Die Steel

Firth-Sterling Steel Co., McKeesport, Pa., announces a high-carbon, high-chromium alloy steel in which resistance to machining in the annealed state has been reduced to a minimum. According to the manufacturer this has been obtained without sacrificing the ultimate hardness after final heat-treatment. Annealed Cromovan has a maximum hardness of 210 Brinell, 35 Scleroscope (Shore Model C), 97 Rockwell B, or 23 Rockwell C. Extreme hardness is produced whether it is quenched in air, oil or water. These two characteristics are designed to permit low die cost and high production.

Variable Speed Transmission

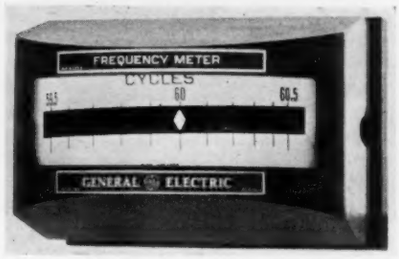
Reeves Pulley Co., Columbus, Ind., has brought out an improved Reeves variable-speed transmission. It is a compact, self-contained, mechanical unit, designed to provide adjustable speed regulation for any type of production machine. Its usual application is in connection with a constant speed motor, which may be mounted directly above the transmission unit on a special motor base. It is designed for use



on all types of material handling conveyors, various types of annealing and heat treating furnaces and large baking machinery. It is available in 16 different sizes covering horsepower capacities from less than 1 to 150. In some sizes it is possible to obtain as high as 16 to 1 speed ratio.

Frequency Meters

General Electric Co., Schenectady, N. Y., has added to its line of switchboard mounting instruments a line of resonant-circuit type frequency meters in which the full scale range may be as small as one cycle. They are of horizontal edgewise design and are known as Type H-8. The line includes 5 scale calibrations, the most sen-



sitive having a full scale range between 59.5 and 60.5. Other calibrations are for 2, 5 and 10 cycles, arranged for service for 25, 50 and 60 cycle systems, 110 volts. They are designed to have inappreciable voltage, wave form and temperature errors, even when operated under extreme conditions.

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of **ELECTRICAL MANUFACTURING** is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of **ELECTRICAL RECORD** as heretofore. This Classified Index has been an exclusive **ELECTRICAL RECORD** feature for over thirty-six years.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa Aluminac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.
AMMETERS. See Instruments.
ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.
ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.
ARMORING MACHINES. See Wire Manufacturing Machines.
ARMS, FLEXIBLE. See Tubing Flexible Metallic.
ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp. (Elec'l Dept.) New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Deceleco, Inc., Wayne, Mich.
Federal Insulating Corp., Yonkers, N. Y.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Deceleco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.
Armor Bronze Co., Garwood, N. J
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.

Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Pittsburgh Valve & Fittings Co., Barberton, Ohio. (Cast Iron.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.
BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Braun Bearings Co., Primos, Pa.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton, Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 225 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., Cleveland, Ohio.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Mechanical Devices Co., Aurora, Ill.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. P. B. See Mechanical Devices Co.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
P. O. B. See Mechanical Devices Co.
Reliance. See Metal Saw & Machine Co.
Selb Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.
BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.
BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y
Torrington Mfg. Co., Torrington, Conn.
BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.

BOX BOARD
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago

BOXES, Fibre
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago
BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., Fruit & Willow Sts., Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, Dept. 36, 111 W. Washington Chicago, Ill.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 309 Decatur, Sandusky, Ohio.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago.
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.
Thompson & Norris Co., 212 Concord, Brooklyn, N. Y.
BRAIDING MACHINES. See Wire Manufacturing Machines.
BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.), Baltimore, Md.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 812 Orleans, Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)

Brush Holders	See H
Carbon, Graphite, Metal Graphite	See C
Flexible Leads and Pig Tails	See L
Sheet Metal	See S
Wire Gauze	See W

Automotive Mfg. Co., Kansas City, Mo.											H		
B B B. See Becker Bros. Elec'l Corp.													
Baylis Co., Bloomfield, N. J.											H		
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill.									C	W	S	H	L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.									C				
Boston Woven Wire Brush Co., Northboro, Mass.										W			
Boxill-Bruel Carbon Co., Columbus Park, O.									C			H	
Burrows & Co., 1135 W. Van Buren, Chicago, Ill.									C				
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa.									C				
Carbon Engrg. Co., Slinger, Wis.									C				I
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O.									C				
Carbon & Graphite Products Co., 227 West Broadway, New York, N. Y.									C				
Carenco. See Carbon Engineering Co.													
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y.									C	W	S		L
Columbia Machine Wks., & M. I. Co., 263 Chestnut, Brooklyn, N. Y.												H	
Cooley Mfg. Co., 98 Park Place, New York										W			
Diamond C. See Chapin Co., Chas. E.													
Dixon Crucible Co., Joseph, Jersey City													
Electra. See Automotive Mfg. Co.													
Electric Accessories Co., 310 York Ave., Philadelphia, Pa.												H	
Electro-Nite Carbon Co., 303 N. Fourth, Philadelphia, Pa.													
Eureka Copper Products Corp., North East, Pa.										W	S	H	
Fleck Carbon Co., 508 Broome, New York									C				
General Electric Co., Schenectady, N. Y.									C			H	
Graphalloy. See Graphite Metallizing Corp.													

BRUSHES, Commutator—Continued
Graphite Metalizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. ..... C . . . . H . .
Henrite Products Co., 98 Park Place, New York, N. Y. ..... C . . . . . .
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio .... H . .
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) ..... C . . . . . .
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. ..... C . . . . . .
Kohlenite Products Co., 417 W. 28th, New York, N. Y. ..... C . . . . . .
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 3608 Grand Central Terminal, New York, N. Y. C . . . . . .
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. ..... C . . . . . .
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. ..... C . . . . . .
National Carbon Co., Cleveland, O. ..... C . . . . . .
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. ..... C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio ..... C W . . . L
Ohio Elec. Specialty Mfg. Co., Troy, O. .... W . . . . .
Perfection Supply Co., 98 Park Pl., New York, N. Y. ..... C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. ..... C . . . . . .
Pure Carbon Co., Wellsville, N. Y. ..... C W S . . L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. .... W L
Salem Electrical Supply Co., Salem, Mass. . . W . . . . .
Seabury, Ralph L., Factories Bldg., Toledo, O. C . . . . . .
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. ..... C . . . . . .
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. ..... C L
Speer Carbon Co., St. Mary's, Pa. ..... C . . . . . .
Stackpole Carbon Co., St. Mary's, Pa. .... C . . . . . .
Sterling. See Carbon Laboratories Co.
Superior Carbon Products, Poughkeepsie, N. Y. ..... C . . . . . .
U. S. Graphite Co., Saginaw, Mich. ..... C . . . . . .
Unico. See Universal Carbon Co.
Universal Carbon Co., Dundee, Ill. ..... C . . . . . .
Universal. See Graphite Metalizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L

BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUGGIES. Armature. See Lifts. Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.

BUNCHING MACHINES. See Wire Manufacturing Machines.

BUSHINGS, SHAFT. See Bearings and Bushings.
CABINET GRILL CLOTH. See Cloth, Untreated.
CABINETS, Ice Cream. See Refrigerator Cabinets.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Vulcawood. See Diamond State Fibre Co.

CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
American Elec. Switch Corp., Minerva, O.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W. Monroe, Chicago, Ill.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1230 E. 16th, Los Angeles, Cal.
Diamond C. See Standard Elec. Supply Co.
Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Box & Switchboard Co., 500 S. Thorp, Chicago.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dall Mfg. Co., 606 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Moher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezioh. See Holzer Sheet Metal Works.
Security. See Aurora Steel Products Co.
Standard Elec. Supply Co., 223 N. 13th, Philadelphia, Pa.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
States Elec. Mfg. Co., 703 Plymouth Ave., N., Minneapolis.
Superior Switchboard & Devices Co., 420 Schroyer Ave. Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

Die Castings

Aluminum, Tin, Lead and White Brass, Special Machines, Dies, Tools, Jigs and Stampings

Advance Tool & Die Casting Co.
1654-60 Holton St., Milwaukee, Wis.
Edgewood 284

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 63rd St., Cleveland, O.
Buckeye. See Studner Bros.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Dekker Co., Geo., Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Eflein & Sons, Frederick, 41 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Rano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
Natural Voice Talking Mach. & Radio Cabinet Co., Oneida, N. Y.
New England Box Co., Greenfield, Mass.
Nyhuis Furniture Co., Holland, Mich.
Parker-Young Co., 131 State, Boston, Mass.
Pierson Co., 836 Cedar, Rockford, Ill.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago,
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pillied Lumber Co., Swanton, O.
Radio Master Corp. of America, Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Straus Cabinet Wks., Eugene, Baxter Ave., Louisville, Ky.
Stettner Phonograph Corp., 318 E. 75th, New York.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.

CABLE ARMORING MACHINES. See Wire Manufacturing Machines.
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington,
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Phoenix Glass Co., 230 5th Ave., New York, N. Y.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibro Products Co.

CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.

CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Ortelip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.

CARTONS. See Boxes and Wrappers.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.

CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., 2512 E. Grand Blvd., Detroit.

Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.
Twin City Die Castings Co., Talmadge and 33rd Ave., Minneapolis, Minn. (White Metal).
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Barnhardt Bros. & Spindler, Monroe & Thropp St., Chicago,
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Illinois Die Casting Co., 551 W. Congress, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
North Wales Mach. Foundry Co., North Wales, Pa.
Snead & Co., Pine St., Jersey City, N. J.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark, N. J.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 31 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., S. 116 Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 116 Sheridan Sq., Pittsburgh, Pa.
Thermold. See Technical Products Co.

CHAIN, Chandelier (Fancy). See Crystals, Chandelier.
CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.
Waterbury Mfg. Co., Waterbury, Conn.

CHAIN, Power Transmission

American High Speed Chain Co., 221 E. South, Indianapolis
Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 12 Wooster St., New York.
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.

CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier.
CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
New Jersey Zinc Co., 160 Front, New York, N. Y. (Zinc Chloride.)
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

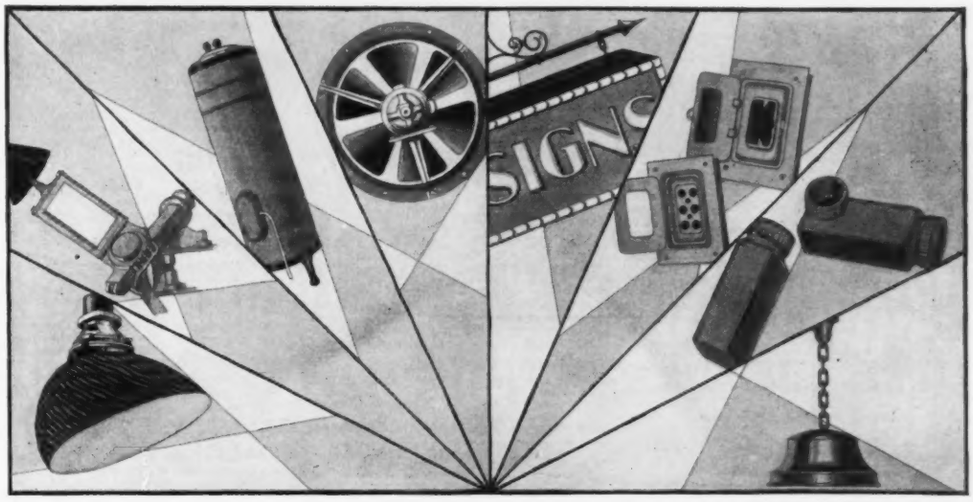
CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S (Rockdale), Worcester, Mass.

This "Coat-of-Metal" *Looks Better— Lasts Longer*



THE crisp, silvery gray freshness of a coat of Aluminum Paint does more than add to the good looks of your product.

For this "coat-of-metal" provides a tough, enduring protection against rust, corrosion and the elements. It makes good products last longer.

As Aluminum Paint is applied its tiny flakes overlap, "leaf" together and form a film of non-rusting metal—more durable than coats of ordinary paint.

Aluminum Paint is economical, too. It may be applied by brushing, spraying or dipping. It spreads farther and covers better—yet costs no more than ordinary paints. One coat will cover *any* under color.

Every production man should have a copy of the booklet, "Aluminum Paint, the Coat-of-Metal Protection," which fully explains its remarkable properties. We will gladly send you a copy on request.

The pigment base for the better grades of Aluminum Paint is ALBRON made of pure ALCOA Aluminum.

In buying Aluminum Paint, tell your dealer how you propose to use it—and whether indoors or out. Most good paint dealers are prepared to furnish the kinds best suited to your needs. If yours is not, write us, giving us his name and address, and we will see that he is supplied.

ALUMINUM COMPANY OF AMERICA

ALUMINUM IN EVERY COMMERCIAL FORM

2444 Oliver Building Pittsburgh, Pa.

Offices in 19 Principal American Cities

A few of the many products which are improved by a coat of Aluminum Paint:

Conduit fittings	Lighting fixtures	Reflectors
Electric signs	Motion picture apparatus	Switch Boxes
Fixture fittings		Ventilators
House Pumps	Pole line hardware	Water Heaters

ALUMINUM PAINT

"IT LEAFS"

"GRAY"

HEATER PLUG CLIPS

Made in large quantities on special machines. Manufacturers buy from us for less than it would cost them to make their own contacts. Shall we mail samples and prices to you?

CONTRACT WORK—Let us manufacture your product and serve as your factory. Write us.

GRAY BROTHERS, Inc., Plano, Ill.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 517 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Taksmine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Oakite Products, Inc., 26 Thames, New York, N. Y.

CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Plano, Ill.

CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH UNTREATED

Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Boyle & Co., John, 112 Duane, New York, N. Y.
Tindall Fabrics Corp., Pawtucket, R. I. (Grill Cloth).
Walker Cotton Fabrics Co., 327 S. La Salle, Chicago, Ill. (Cotton Duck)

CLOTH AND PAPER, Insulating

Cloth, Insulated .....See C
Paper, Insulated .....See P
Fibre Paper (Fish Paper) .....See F
Press Board (Fuller Board)....See B
Silk .....See S

Acme Wire Co., New Haven, Conn..... C S P . . .
Armatite. See Mica Insulator Co.
Brand & Co., Wm., 268 Fourth Ave., New York ..... P . . .
Campbellite. See Campbell Fibre Co.
Campbell Fibre Co., Stanton, Delaware..... B
Carboloid Products Corp., 15 Park Row, New York, N. Y..... C .. P . . .
Case Brothers, Inc., Highland Park, Conn.. . . . . B
Case Mfg. Co., Unionville, Conn..... P . . .
Case & Aisley Press Paper Co., Oneco, Conn. . . . . .
C-F. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa..... P F B
Chicago Mica Co., Valparaiso, Ind..... C . . . . . .
Dexstar. See Dexter & Sons.
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)
Diamond State Fibre Co., Bridgeport, Pa.. . . . P . . .
Dielectric Mfg. Co., St. Louis, Mo..... C S P . . B
Federal Insulating Corp., Yonkers, N. Y... C . . P F . .
Fyberoid. See Wilmington Fibre Specialty Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C . . P . . .
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).
Hewitt & Bros., C. B., 16 Ferry, New York C .. P . . .
Hi-Tex. See Stevens Paper Mills.
Incella. See Tarentum Paper Mills Co.
Irvington Varnish & Insulator Co., Irvington, N. J. ..... C S P . . .
Manning Paper Co., J. A., Troy, N. Y..... B
Mica Insulating Co., 200 Varick, New York C S P . . B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. ..... P . . .
National Vulcanized Fibre Co., Wilmington, Del. ..... F . .
New Jersey Wood Finishing Co., Woodbridge, N. J. ..... C . . . . . .
Ohmold. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass. . . . . F . .
Rogers Paper Mfg. Co., South Manchester, Conn. ..... B
Schweitzer, Peter, 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)
Scutan Co., 342 Madison Ave., New York . . . . P . . . .
Sico. See Standard Insulation Co.
Spaulding Fibre Co., Tonawanda, N. Y..... F . .
Standard Insulation Co., Rutherford, N. J. C S P . . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varied Hard Fibreboard)..... B
Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn..... B
Tarentum Paper Mills Co., Tarentum, Pa.. . . . P . . .
Turbonite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. . . . P . . .
Warren Mfg. Co., 342 Madison Ave., New York, N. Y. ..... P . . .
West Virginia Pulp & Paper Co., 200 5th Ave., New York..... B
Wilmington Fibre Specialty Co., Wilmington, Del. ..... P . . .

CLUTCHES, Magnetic

Cutler-Hammer Mfg. Co., Milwaukee, Wis.

COIL (Coils).

Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished

Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., 22 Elkins (South Boston), Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York, A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Coilton Elec. Mfg. Co., Easton, Pa.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden, Electrical Products Mfg. Co., Providence, R. I.
Irvington Varnish & Insulator Co., Irvington, N. J.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pfefer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Sevison Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2242 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
U. S. Armature Service Co., 1617 S. Michigan Ave., Chicago, Ill.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR

Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS

Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.

COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator

Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.

CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor

Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-Q Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dinkey. See Elec. Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 292 Hudson, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.

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Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
U. S. Elec'l Mfg. Co., 200 E. Slauson Ave., Los Angeles
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.

COPPER. See Brass, Bronze and Copper; also Castings.
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitrecall. See Thermal Syndicate.

COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)

Bartlett Hayward Co., Baltimore, Md.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J.
Wood's Sons Co., T. B., Chambersburg, Pa.

COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease

Bowen Products Corp., Auburn, New York.
Lunkenheimer Co., Cincinnati, Ohio.

CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier

Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y. (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia.
Weis & Bros., J. J., 20 E. 27th, New York, N. Y.

CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA

Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS

Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled

Whittler Co., Horace R., Pequabuck, Conn.

DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS

Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature

Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland.
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.

DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady

EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

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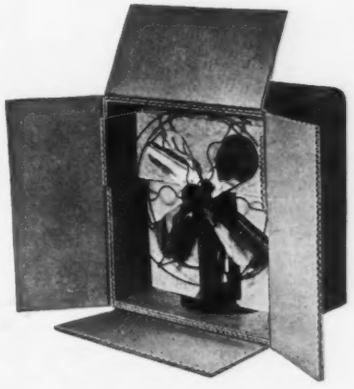

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Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Luma Elec. Equipment Co., 407 Spitzer Bldg., Toledo, O.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel

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Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Etch-O-Gravure. See Insuline Corp. of America.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., Newark, N. J.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati,
Wright Radio Co., 114 Exchange, Rockland, Mass.

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EYELETS

Platt Bros. & Co., Waterbury, Conn.

FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.
FEET, FELT. See Felt.

FELT

Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4031 Ogden Ave., Chicago, Ill.

FERRULES

Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.

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Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.
Mid-West Box Co., Dept. 6, 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.

FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol

Moisture Proof; Sheet, Rod, Tubes.
Bakelite-Dilecto. See Continental Fibre Co.
Bakelite-Duresto. See Spaulding Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized

Sheet, Rod, Tube, Horn. Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Agasote Millboard Co. (Fernwood), Trenton, N. J.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Conite. See Continental Fibre Co.
Cocheco. See Spaulding Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Agasote Millboard Co.
Fibro Products Co., New Bedford, Mass.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Ten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp

Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Sirian Wire & Contact Co., 255 Sherman Ave., Newark.
Suter & Nuetzl, 3709½ Lisbon Ave., Milwaukee, Wis.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

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Ideal Commutator Dresser Co., 1039 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.

FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B

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	KEY
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B
American Pin Co., Waterbury, Conn. I
American Ring Co., Waterbury, Conn. (Candle.) ..... S
Ampinco. See American Pin Co.
Appleton Electric Co. 1703 Wellington Ave., Chicago, Ill. ..... B I
Arco. See American Ring Co.
Arrow Electric Co., Hartford, Conn. ..... S
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit. ..... B
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. ..... B
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) ..... B I
B. & L. Metal Stamping Co., 155 Jamaica Ave., Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I H
Cambridge Brass Co., Cambridge, Mass. ..... B
Cleanezy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B S
Crescent Brass Mfg. Co., Reading, Pa. ..... B
Crouse-Hinds, Solvay Sts., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) ..... B I
Dunlap Co., John, Carnegie, Pa. ..... S
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. I
Fralick Co., S. R., 15 S. Clinton, Chicago. I
Franklin Brass Foundry Co., Reading, Pa. ..... B
Friedley-Voshardt Co., Chicago ..... B
Full-O-Lite Co., 50 Dey, New York, N. Y. ..... B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. ..... B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Lanco Mfg. Co., 228 Jelliff Ave., Newark, N. J. (Cross Bar.) I
Liberty Brass Turning Co., 203 Lafayette, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I
Liberty Machine Co., Wauwatosa, Wis. ..... B I
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. ..... H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. ..... B
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Macallen Co., Foundry St., Boston, Mass. I
Metal Products Co., 210 Canal, New York ..... B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S
Monarch. See Perfectite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B
Nobolt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onli. See Perfectite Co.
Pass & Seymour, Solvay Sts., Syracuse, N. Y. ..... B S
Perfectite Co., 1457 E. 40th, Cleveland. ..... S
Pittsburgh Valve & Fittings Co., Barberton, O. I
Plume & Atwood Mfg. Co., Waterbury, Conn. ..... B S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Yeater Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. ..... B I
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. ..... B
Rossle Mfg. Co., 200 Hudson, New York ..... B H
Sandow Tool Co., 1440 Bway, New York, N. Y. ..... S
Scovill Mfg. Co., Waterbury, Conn. ..... B I

Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Smoot-Holman Co., Inglewood, Cal. (Ceiling Reflectors) ..... B
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia. ..... B
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B
Star. See Perfaclite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. ..... B S
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York I
Triumph Mfg. Co., 310-13, West New York, N. J. ..... S
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. ..... B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B
Walden Tool & Metal Mfg. Co., New Haven Conn. .....
Wa-Me-Co. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. ..... B
Waterbury Mfg. Co., Waterbury, Conn. ..... B S
Waterbury Metal Wares Co., Waterbury, Conn. ..... S
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. ..... B S
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B
Zamora. See American Pin Co.

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See National Appliance Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Cramblet Engineering Corp., 280 Guttenberg, Milwaukee,
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 292 Hudson, New York, N. Y.
Hotchkiss. See Cramblet Engineering Corp.
Jewel Elec. & Mfg. Co., 4505 Ravenswood Ave., Chicago, Ill.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Magnetic Sign Flasher Co., Seattle, Wash.
Mercury. See Betts, Inc., James H.
National Appliance Co., Linden, Mich.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Puritan Elec. Circuit Breaker Corp., 1 E. 42nd, New York.
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Sledoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.
FLEXIBLE SHAFT. See Tubing, Flexible Metallic.

FORGINGS, Non-Ferrous

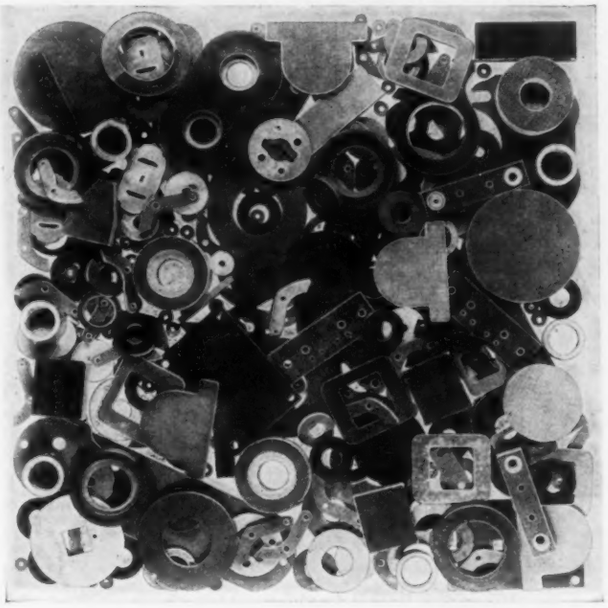
Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire

Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport, Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Timberlake & Sons, J. B., Jackson, Mich.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.



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FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY
Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. .. P . . . . .
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Co., Hartford, Conn. .. P N . . .
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. .. P . . . . .
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis ..... C P N R O
C. E. Z. See Automatic Elec. Iron & Fuse
Chase-Shawmut Co., Newburyport, Mass... C P N R O
Chicago Jefferson Fuse & Electric Co., 1505 W. 15th St., Chicago, Ill. ..... C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) ..... C . . N R . .
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P . . R . .
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh ..... C . . . . R . .
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... C P N R . .
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R . .
Elliott Electric Co., Shreveport, La. .. . .
Gem. See Chicago-Jefferson Fuse & Electric
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C P N R . .
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C . . . . . .
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. ..... C . . . . R . .
H. & H. See Hart & Hegeman Mfg. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. .. P . . R . .
Hudson Wire Co., Ossining, N. Y. .. . . . . O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. ..... C P N . . O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. ..... C . . . . . .
Monarch Fuse Co., Jamestown, N. Y. ..... C . . N R . .
National. See Economy Fuse & Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. ..... C P . . R . .
Platt Bros. & Co., Waterbury, Conn. .. . . . . O
Powell, F. W., 119 W. Ohio, Pittsburgh .. P . . R . .
Ree-Nu-It Elec. Co., New Bedford, Mass.. C P . . R . .
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. ..... C . . . . R . .
Royal Elec. Co., Chelsea Station, Boston.. . . P N . . . .
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P . . R . .
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee ..... C P N R . .
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattle & Bros., Joseph P., Gaul and Letterly Sts., Philadelphia, Pa.
GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.
GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
Smith Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Philadelphia Gear Wks., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago,
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.
GENERATORS, Electroplating. See Plating Generators.
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Berylite. See Plaut & Co., L.
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delfos-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Glass Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kauffeld Glass & Ceramic Co., Star City, W. Va.
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
Marbe. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Mellilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearitone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phene. See Phoenix Glass Co.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestepal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Reiter, G. C., Canton, O.
Waterbury Mfg. Co., Waterbury, Conn.

The Simplex Refillable
FUSE PLUG
The plug that can be refilled with standard fuse wire.
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GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.
HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
ICE CREAM CABINETS. See Refrigerator Cabinets.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.
INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscillosopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill.
Eppley Laboratory, Newport, R. I. (Standard Cells.)
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kaasen. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Pignolet Instrument Co., 76 Greenwich, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Simplex. See Leeds & Northrup Co.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa.
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y. (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., Garrison Place and French St., Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich.
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2331 Prospect Ave., Cleveland, Ohio.
Tiffany Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.
See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Alnor. See Illinois Testing Laboratories.
Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., 136 Liberty, New York, N. Y.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Crit-Point Meters. See Illinois Testing Laboratories.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Ohmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boyiston, Boston, Mass.
Illinois Testing Laboratories, 149 W. Austin Ave., Chicago.
I. T. L. See Illinois Testing Laboratories.
Jaynes, R. F., Lynn, Mass.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill

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This process insures tubing of high insulation value plus low moisture absorption, and has met with immediate acceptance by leading radio manufacturers for winding coils.

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Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elect. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn N. Y.
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elect. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elect. Inst. Co., 81 Hilliard, Manchester, Conn.
Panelitest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pignolet Instrument Co., 76 Greenwich, New York, N. Y
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elect. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Stitch Co., H. H.
Sterling Mfg. Co., 2331 Prospect Ave., Cleveland, Ohio
Stitch & Co., H. H., 13 Park Row, New York, N. Y
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thomspon-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Stitch & Co., H. H.
Two-in-One. See Stitch Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Weinberg & Co., 870 Blue Island Ave., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elect. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)
Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS
Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS
Baker Perkins Co., Saginaw, Mich.
INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy
Diamond State Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Macallen & Foundry, Boston, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass
For Composition Jars. See Molded Insulation; also Rubber.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing
Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Macallen & Foundry, Boston, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White & Co., O. C., 17 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES
(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan.

Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES
Sign Letter, Flashlight, Projector and Reflector.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Clinton Sign Co., Clinton, Ia.
Consolidated Lamp & Glass Co., Coraopolis, Pa. (Flashlight)
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa. (Flashlight.)
North Lights Co., 30 W. 15th, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)

LETTERS, Sign
Glass. Metal.
Adlign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs Inc., 2736 Wentworth Ave., Chicago, Ill.
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature
Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

LININGS, Socket
Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

LOUD SPEAKERS
Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.
Air-Chrome. See Temple, Inc.
American Reproducer Corp., 55 W. 42nd, New York, N. Y.
A. R. C. See American Reproducer Corp.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Borkman Radio Corp., 152 E. Seventh, S. Salt Lake City, Utah.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4850 Stenton Ave., Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 42nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill
Lata Balsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powertone Elec. Co., 222 Fulton, New York, N. Y. (Kit.)
Puropower. See Platter Cabinet Co.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Ralliotire Corp., 21st Ave. and 53rd, Brooklyn, N. Y.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swchoda Co., Maritime Bldg., Seattle, Wash.
Teletone Corp. of America, Third St. & Van Alst Ave., Long Island City, N. Y.
Temple, Inc., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
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Zisch Engineering Corp., Newark, N. J.

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French Mfg. Co., Waterbury, Conn.
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Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

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Luminous Compound	See C
Pendants (Bulbs)	See P
Standard Parts	See S

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Arrow Electric Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn. . . . . P
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . S . .
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.
Eagolite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. . . . . P
General Electric Co., Merchandise Dept., Bridgeport, Conn. . . . . S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. . . . . S P
Hubbell, Inc., Harvey, Bridgeport, Conn. . . . . P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 5532 Forbes, Pittsburgh, Pa. . . . C . . P
Reynolds Spring Co., Jackson, Mich. . . . . S . .
Rodale Mfg. Co., 200 Hudson, New York, N. Y. . . . . P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia . . P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. . . . . C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES
Armature Banding. See Banding Machines, Armature.
Armature Notching. See Notching Machines, Armature.
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making.
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making
For Making Incandescent Lamps and Vacuum Tubes.
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Berrenberg, R., 12 Farnham (Roxbury), Boston, Mass. (Vacuum Pumps.)
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York, N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines.
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent
Bulleus Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chica
Rovers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Sticht & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard.
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
METAL CUTTING OUTFITS. See Welding and Cutting Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines.
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools, Commutator.

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Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Dielectric Mfg. Co., St. Louis, Mo.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 14 Lispenard, New York, N. Y.
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Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Minerals & Insulation Co., 101 Spring, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K, 804 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp)
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Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co. Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED
Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.

MOLDED INSULATION

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Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., 420 Lexington Ave., New York.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brecolite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
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Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
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Everecol. See Bakelite Corp.
Federal Insulating Corp., Yonkers, N. Y.
Fedrelin. See Federal Insulating Corp.
Fenoline. See Insuline Corp. of America.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 96 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
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Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Elyria, O.
Isolantite Co. of America, Inc., Zellville, N. J.
Johnson Molding & Tool Co., Weymouth, Mass.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Keystone Specialty Co., 2373½ Coventry Rd. (Lakewood), Cleveland, O.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Lavamix. See Splitdorf Radio Corp.
Macallan Co., Macallan and Foundry Sts., Boston, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohum. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
National Lead Co., 111 Broadway, New York, N. Y.
Niagara Insul-Bake Specialty Co., 183 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonold. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Renlite. See Nixon Nitration Works.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 304 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Splitdorf Radio Corp., Newark, N. J.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Synamix. See Garfield Mfg. Co.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
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MOTOR CONTROLLERS. See Controllers, Motor.
MOTOR PLATFORM BASES. See Bases, Motor Platform.
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches, Snap (Heavy Duty).

MOTORS

Alternating Current ..... See S
Direct Current ..... See S
Motors, 1 Hp. up ..... See M
Motors Fractional Hp. ..... See F
Universal ..... See U

Acme Elec. & Mfg. Co., 1653 Rockwell, Cleveland M . . . . .
Actodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S . .
Allis-Chalmers Mfg. Co., Milwaukee, Wis. . . . . M . . S . .
Allis Co., Louis, Milwaukee, Wis. . . . . M . . S . .
American Brown Boveri Elec. Corp., Graybar Bldg., New York, N. Y. . . . . M . . S . .
American Elec. Motor Co., Cedarburg, Wis. . . . . M . . . . .
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland . . F S U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa. M . . . . .
A. R. S. See Westinghouse Elec.
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S . .
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago. . . . . F S U
Bogue Elec. Co., Chas. J., 132 King, New York M . . . . .
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O. . . . . M F . . .
Burke Elec. Co., Erie, Pa. . . . . M F S U
B. T. See Allis Co., Louis.
B & R Mfg. Co., 812 Lafayette, Toledo, O. . . . . F . . .
Cah. See Westinghouse Elec. Mfg. Co.
Century Elec. Co., 1806 Pine, St. Louis, Mo.. M F S . .
Chandeysson Elec. Co., St. Louis, Mo. . . . . M . . S . .
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky. . . . . M . . . . .
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Cushman Elec. Co., Concord N. H. . . . . M F S . .
Day-Fan Electric Co., Dept. A, Dayton, O. . . . . F S . .
Diehl Mfg. Co., Elizabeth, N. J. . . . . M F S . .
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O. . . . . S U
Dumore. See Wisconsin Elec. Co.
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M . . S . .
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. . . . . S U
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J. . . . . M . . S . .
Emerson Electric Mfg. Co., 2015 Washington Ave., St. Louis, Mo. . . . . M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. . . . . M . . S . .
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., Chicago, Ill. . . . . M F . . .
Fidelity Elec. Co., Lancaster, Pa. . . . . M F S U
Fitzgerald Mfg. Co., Torrington, Conn. . . . . F . . .
Fynn Weichsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo. . . . . F . . S . .
General Elec. Co., Schenectady, N. Y. . . . . M F S U
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Hamilton Beach Mfg. Co., Racine, Wis. . . . . F S U
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Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S . .
Howell Elec. Motors Co., Howell, Mich. . . . . M . . S . .
Ideal Elec. & Mfg. Co., Mansfield, O. . . . . M . . S . .
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Jeanin Electric Co., Toledo, O. . . . . M F S . .
Kendrick & Davis Co., Lebanon, N. H. . . . . F S . .
Kimble Elec. Co., 634 N. Western Ave., Chicago M . . S U
King Elec. Co., 35 Murray, New York. . . . . M . . . . .
Knapp Elec. Corp., Port Chester, N. Y. . . . . F S U
Leland Elec. Co., Dayton, O. . . . . F S . .
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio. . . . . M . . S . .
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O. . . . . M . . . . .
Mando Co., Syracuse, N. Y. . . . . F . . . .
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. . F . . . .
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Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y. . . . . F . . U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M . . . . .
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O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M . . . . .
Pan. See Chandeysson Elec. Co.
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
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Rotator. See Bodine Elec. Co.
Roth Bros. & Co., Chicago, Ill. . . . . M . . S . .
Standard. See Robbins & Myers Co.
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Walter Elec. Mfg. Co., Norfolk, Va. ..... M .. S ..
Watson. See Allis Co., Louis.
Welco Uniframe. See Wesche Elec. Co., B. A.
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Westinghouse Elec. Mfg. Co., East Pittsburgh M F S ..
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Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

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Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing ..... See L
Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich. L
Acme Wire Co., New Haven, Conn. V
Acmewire. See Acme Wire Co.
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. V
American Lastite Co., 3166 Lincoln Ave., Chicago. .. P L
Antakwa Co., 1329 Mohawk, Chicago, Ill. ..... P

Apexior. See Dampney Co. of America.
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. ... L
Armlac. See Robertson Chemical Co.
Arolac. See Arizona Lacquer Mfg. Co.
Art-O-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Colt, Irvington, N. J. L
Atom Chemical Co., 96 E. 10th, New York, N. Y. L
Bakelite Corp., 247 Park Ave., New York, N. Y. L
Belden Mfg. Co., 2310B, S. Western Ave., Chicago
Benolite Co., 501 Columbia Bank Bldg., Pittsburgh. V P ..
Berry Bros., Leib & Wight, Detroit, Mich. ..... V ...
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V ...
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Bradley-Hurtz Co., 2626 S. Dearborn, Chicago, Ill. ... L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. ..... V P ..
Carboloid Products Corp., 15 Park Row, New York. V P ..
Chinalac. See Dolph Co., John C.
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... V P ..
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzeins, Columbus, O. V ...
Comulac. See Martindale Elec. Co.
Dampney Co. of America, Boston, Mass. ..... V ...
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P ..
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del. .. P ..
Eastman Kodak Co., Rochester, N. Y. L
Eclipse Paint & Mfg. Co., Cleveland, O. ..... P ..
E. B. See Mitchell-Rand Mfg. Co.
Egyptian Lacquer Mfg. Co., 90 West, New York. ... L
Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
Ever-Brite Products Co., East Liverpool, O. L
Federal Insulating Corp., Yonkers, N. Y. ..... V P ..
Flex-ib-lac. See Dielectric Mfg. Co.
Franche & Co., 440 Orleans, Chicago, Ill. L
General Elec. Co., Mds. Dept. Bridgeport, Conn.. V P ..
General Plastics, Inc., 96 Walck Rd., N. Tonawanda, N. Y. ..... V ...
George Co., P. D., St. Louis, Mo. ..... V ...
G. E. See General Elec. Co.
Glidden Co., Cleveland, O. ..... V P L
H. B. See Maas & Waldstein Co.
Hercules Powder Co., Wilmington, Del. ..... V ...
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. ..... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh. V P ..
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. ..... P L
Laqueroid. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. & Co., 450 E. 3rd, Dayton, O. ..... V P ..
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P ..
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. ..... V P ..
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. ..... V ...
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York. .... V ...
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P ..
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. ... L
O'Brien Varnish Co., South Bend, Ind. ..... V P L
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. ..... P ..
Opex. See Sherwin-Williams Co.
Oxite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Co., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Proxlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. .. P L
Republic Varnish Co., 200 Thomas, Newark, N. J. V ...
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. ..... V P ..
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Rockbestos Products Corp., New Haven, Conn.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn. ..... .
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y. ..... V P ..
Sherwin-Williams Co., Cleveland, O. ..... V P L
Sipe & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 610 Broadway, Kansas City, Mo. ..... V P ..
Standard Flexible Comp. Co., Franklin Trust Bldg., Philadelphia, Pa. ..... V P ..
Standard Insulation Co., Rutherford, N. J. ..... V ...
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa. ..... P ..
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa. ..... V ...
Toch Bros., 443 4th Ave., New York ..... V P L
Truscon Laboratories, Canift & Grand Trunk Railway, Detroit, Mich. ..... V ...
2098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y. ..... V ...
Voltac Co., 99 Reservoir Ave., Bridgeport, Conn. V P ..
Vulcan-Lastite. See American Lastite Co.
Walker Co., Henry V., 17 John St., New York. L
Walpole. See Robertson Chemical Co.
Waukegan Chemical Co., North Chicago, Ill. L
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. V P ..
Zapon Co., Stamford, Conn. L
Zellac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York. L

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Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.

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Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
Fish. See Cloth & Paper.
Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.

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PINIONS. See Gears and Pinions.

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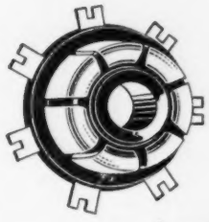

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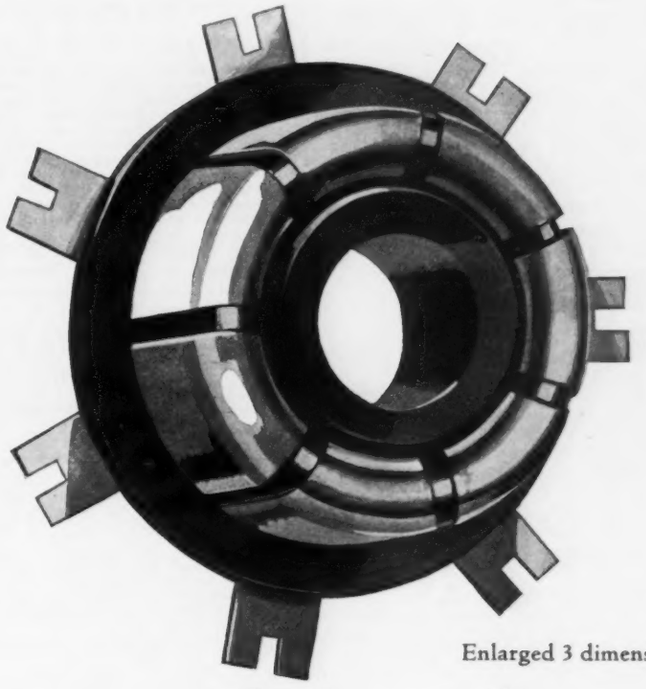

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Able is as able does

IN considering molding service, to you the important word among the questions in the back of your head is *able.*

Will the molders be *able* to make those molds, those inserts? *Able* to meet that delivery date?

Every job in International's widely varied and heavy production flow has the same questions back of it. And the same definite answer to every such question for every job is given before it starts: Yes!

International molding service operates only on the principle of being able. Every job started must be finished on schedule and finished right.

As for many years past, we assume complete responsibility for everything, including your satisfactior

PRECISION MOLDERS OF BAKELITE AND SHELLAC COMPOSITION

INTERNATIONAL INSULATING CORPORATION

Division of The General Industries Co.

ESTABLISHED 1875 ELYRIA, OHIO

Best facilities, great experience, and full-capacity production on a large scale are at your command in International molding service. Estimates gladly furnished without obligation.

PLATES, Storage Battery

Am-Plus Storage Battery Co., 425 W. Superior, Chicago.
Aro Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Champion. See Englert Mfg. Co.
Continental Battery Co., Papin and Compton, St. Louis, Mo.
C. & B. Battery Co., 1535 S. State, Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Esto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Hemrick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 656 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

PLATING GENERATORS

American Giant. See Connecticut Dynamo Motor Co.
Bogue Elec. Co., Chas. J., 132 King, New York, N. Y.
Burke Elec. Co., Erie, Pa.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamox Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 522 Newell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Specialty Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.
Jantz & Feist Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.
L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago, Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Pan. See Chandeysson Elec. Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Elec. Mfg. Co., East Pittsburgh, Pa.

PLATING AND FINISHING

Chromium Plating, Rust Proofing and other special metal-finishing processes.
Amalog. See American Machine & Foundry Co.
American Machine & Foundry Co., 511 Fifth Ave., New York, N. Y.
Atlantic Chemical Co., Coit, Irvington, N. J.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich. (Chromium Plate.)
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
United Chromium, 30 E. 42nd, New York, N. Y.
Udylite Process Co., 3220 Bellevue Ave., Detroit, Mich. (Rust-Proof Finish.)

PLATINUM,

Sheet, Rod, Tubing, Wire.
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
R. & H. Platinum Works, 709 Sixth Ave., New York.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.
PLUG RECEPTACLES. See Receptacles, Plug.
PLUGS, Flashing. See Flashers, Sign.
PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment

A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4605 W. Madison, Chicago.
Anselite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Elec. Co., Hartford, Conn.
Arro-Grip. See Arrow Elec. Co.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
Belden Mfg. Co., 2310 S. Western Ave., Chicago, Ill. (Special Soft Rubber Plug Furnished with Belden Cords).
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Elec. Co., Bridgeport.
C. H. See Cutler-Hammer Mfg. Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn.
Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Moulded Products Corp., Meriden, Conn.
Consolidated Gas Iron Co., 32 Union Square, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., Dept. ER4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3257 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
Felco Products Co., 124 S. Calvert, Baltimore, Md.
Fitzall. See Rodale Mfg. Co.
Gaynor Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
General Elec. Co., Bridgeport, Conn.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Heetach. See Marks Products Co.
Hemco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Imperial. See Consolidated Gas Iron Co.
Iona Co., Los Angeles, Cal.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Jiffy. See Esler Elec. Mfg. Co.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.

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BAKER & CO., INC.
54 Austin St. Newark, N. J.

Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.
Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York.
Quick Catch. See Hubbell, Inc., Harvey.
Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 1015 Chestnut, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 252 Lafayette, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitzall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedeo. See Paragon Elec. Sales Co.
Tellitale Tap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
U. S. Electric Co., 311 Chambers, Trenton, N. J.
Utilo Mfg. Co., 320 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact

American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory & Co.), Portchester, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Independent Contact Point Co., 545 39th, Union City, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Rano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 23 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.
POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN

Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes

Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Carey Ohio Porcelain Co., Carey, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metsch Refractories Co., East Liverpool, Ohio.

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East Liverpool, Ohio

National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Parker, J. H., 296 Broadway, New York, N. Y.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
Standard & Specialty Porcelain Co., Sun Prairie, Wis.
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.

POROUS CUPS

Unglazed earthenware cups for primary (wet) batteries.
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding

Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York.
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
Kling. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip.)
Nutmeg. See Hart & Hegeman Co.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 238 Grand, Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.
POTENTIOMETERS (Radio Control). See Radio Receiver Parts.
POWDERED CARBON. See Carbon, Powdered.
POWER TRANSMISSION CHAIN. See Chain, Power Transmission.
PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil

Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation

Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse.
Elmes Engrg. Works, Chas. F., 222 N. Morgan, Chicago, Ill.
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill.
Farquhar Co., A. B., York, Pa.
Loshbough-Jordan Tool & Machine Co., Elkhart, Ind.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5834 Tabor Rd., Olney, Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y.
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding

Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching

Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier.
PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft

Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

PULLEYS, Composition

General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner

Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Mechanical Devices Co., Aurora, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago.
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum

To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Eimer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.

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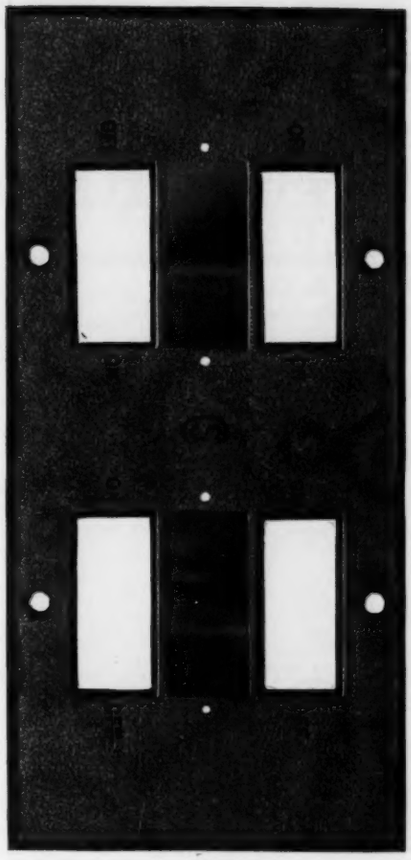

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Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel

(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1820 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS

This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.

Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., 22 Elkins (S. B.), Boston, Mass.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Air-King Products Co., 222 Grand, New York, N. Y. (Kit.)
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Auburn Button Works, Auburn, N. Y.
Audioformer Transformer. See Pacent Electric Co.
Audiohm. See Electrad, Inc.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn, galcon. See Pacent Electric Co.
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Birnbach Radio Co., 254 W. 31st, New York, N. Y.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Crosradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crofok. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
Davohm. See Daven Corp.
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Duopack. See Pacent Elec. Co.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc. (Div. of P. R. Mallory & Co.), Portchester, N. Y
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 800 W. Jackson Blvd., Chicago,
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hammarlund-Roberts, 1182 Broadway, New York. (Kit.)
Harmonik. See Karas Elec. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 280 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isodon. See Auburn Button Works.
Isograd, Isoleak. See Pilot Elec. Mfg. Co.
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Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Leakandenser. See Daven Corp.
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lauts Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Megrit. See Cole Mfg. Corp.
Megostat. See Pacent Elec. Co.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
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Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
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Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Perry Wire Works, 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Piander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg Co., Waukegan, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
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Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radio File. See Pacent Elec. Co.
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Rectox Mfg. Co., 23 W. Third, Cincinnati, O.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
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Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
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S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
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Telos Coil. See Condenser Corp. of America.
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Tobe Deutschman Co., Canton, Mass.
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Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultimax. See Pacent Elec. Co.
Ultra Vario. See Bruno Radio Corp.
Univernier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York,
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Vernit-Juster. See Brooklyn Metal Stamping Corp.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

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Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co., Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Saturn Mfg. & Sales Co., 48 Beekman, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

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Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
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Centralab. See Central Radio Laboratories.
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De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
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Eby Mfg. Co., H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
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Fantail Plug. See Brooklyn Metal Stamping Corp.
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Gem-Jac. See Frost, Herbert H.
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Klosner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
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Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

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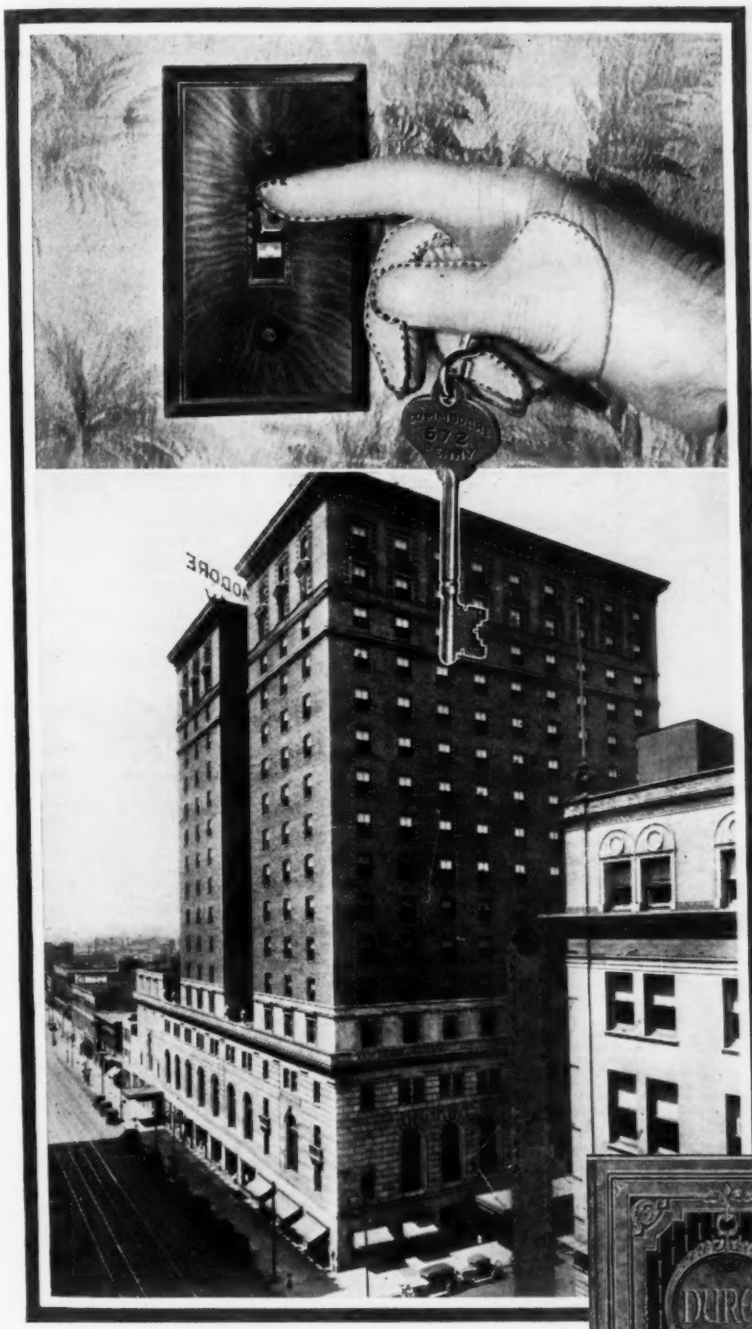

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Gold Seal Electrical Co., 250 Park Ave., New York, N. Y.
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Radio Corp. of America, 233 Broadway, New York.
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Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth. West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington, N. J.
Van Horne Co., 280 Center, Franklin, Ohio.
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Arcturus Radio Co., 255 Sherman Ave., Newark, N. J. (Adapters.)
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Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
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Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa (Adapters).
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
R. U. F. Products Co., 319 Glenmore Ave., Brooklyn, N. Y.
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Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y.

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United States Radium Corp., 535 Pearl, New York, N. Y.
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RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

KEY

Battery Charging ..... See B
Floor Boxes ..... See F
Welding ..... See W
Machine Tool ..... See W
Watertight, Marine, Mine ..... See M
Car Trailer Connection ..... See C
Extension ..... See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Elec. Co., Hartford, Conn. F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse N. Y. B W
Cutler-Hammer Mfg. Co., 1388 St. Paul Ave., Milwaukee, Wis. F
Delta-Star Elec. Co., 2433 Fulton, Chicago W M
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. B
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
General Elec. Co., Bridgeport, Conn. B
H. & H. See Hart & Hegeman Mfg. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
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Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio W
Ostrander Elecl. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Preset. See Walker Bros. Co.
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Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
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Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
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Yale. See Electric Products Co.
RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

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Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Products Co., 140 N. Robey, Chicago, Ill.
Maxolite. See Raleo Mfg. Co.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.
REFRIGERANTS. See Chemicals, Refrigeration.
REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corp., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Automatic. See Illinois Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectriCE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Boyer Refrigerator Co., 2217 Locust, St. Louis, Mo.
Cameo Refrigerator Corp., 973 N. Main, Los Angeles, Cal.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 131 E. 34th, New York, N. Y.
Cold Storage Refrigerator Co., Eau Claire, Wis.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dillingham Mfg. Co., Sheboygan, Wis.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gruendler Mfg. Co., Gustav J., 314 N. Broadway, St. Louis.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
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Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Co., Euclid Ave. at 65th, Cleveland, O.
Hill & Co., C. V., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.

Iceless Cooler Corp., 225 N. Michigan Ave., Chicago, Ill. (Ice Cream Cabinets.)
Illinois Refrigerator Co., Morrison, Ill.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorilliard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Ligonier Refrigerator Co., Ligonier, Ind.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Co., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Northey Mfg. Co., Waterloo, Iowa.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha.
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Ranney Refrigerator Co., Greenville, Mich.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Revolvo. See Iceless Cooler Corp.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal.
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.
REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

RELAYS

(See also Circuit Breakers and Thermostats.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.
REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.
RESISTORS. See Units, Rods & Grids.
REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS.

Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY

Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating. See F

F B D P M L

Allen-Bradley Co., 493 Clinton, Milwaukee L
Biddle, James G., 1211 Arch, Philadelphia L
Boice, W. B. & J. E., 1730 Norwood Ave., Toledo, O. L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.) B
Bradleystat. See Allen-Bradley Co.
Controlite. See Ward Leonard Elec. Co.
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill. P
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. F B D L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa. F
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O. F
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. B
General Electric Co., Schenectady, N. Y. F L
Hanson-Van Winkle-Munning Co., Matawan, N. J. P
Holzmuller, C. J., 1108 Howard, San Francisco, Cal. D
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. D M
Knoeller Elec. Co., De Pere, Wis. F
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago F B D M L
Robertson, Leo F., 536 W. 22nd, New York, N. Y. M
Schaefer Bros. Co., 1059 W. 11th, Chicago B
Simplicity. See Cutler-Hammer Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis. F
Universal. See Ward Leonard Elec. Co.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo. B
Vitrohm. See Ward Leonard Elec. Co.
Ward Leonard Elec. Co., Mt. Vernon, N. Y. F D M
Watton. See Electric Products Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F M
RINGS Seal. See Packing.

RIVETS

Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.

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RIVETS—Continued
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.

ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard
Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Murhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave. New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS
Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co. Youngstown, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge
Toycraft Rubber Co., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction.

RUBBER TUBING. See Tubing, Rubber.

RUST PROOFING. See Plating & Finishing.

SAL AMMONIAC. See Chemicals, Battery.

SALTS, Battery. See Chemicals, Battery.

SATURATING TANKS. See Wire Manufacturing Machines.

SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW MACHINE PRODUCTS
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Celoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis,
Linden & Co., 801 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)
Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive
Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston,
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)
American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.

SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery
Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)

Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Ferry Mfg. Co., St. Louis, Mo.
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES
Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric
Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kelton Mfg. Co., Worcester, Mass. (Silk.)
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Franklin Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Storrs Mica Co., 11 Park Place, New York, N. Y.
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES
Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Handel Co., Meriden, Conn.
Mosaic Shade Co., 589 E. Illinois, Chicago, Ill.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Novelty Lighting Corp., 2488 E. 22nd, Cleveland, O.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic
Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oameo. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.

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Standard Elec. Supply Co., 223 N. 13th, Philadelphia, Pa.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica
Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarnolite. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.

SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.

SHEARS, Insulation
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)
Waterbury Mfg. Co., Waterbury, Conn.

SHUNTS, Instruments. See Instruments, Laboratory Standard.

SIGN FLASHERS. See Flashers, Sign.

SIGN LETTER LENSES. See Lenses.

SILICA
Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.

Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire
Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.

SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.

SKINNERS WIRE. See Scrapers.

SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE
For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Munson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.

SLEEVING, Cotton. See Tape, Cotton.

SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator
(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Burton-Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio.
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE
For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Lin-Stun. See Westinghouse.
Soapstone Products Co., 97 Warren, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket.

SOCKET SHELLS. See Shells, Screw Socket.

SOCKETS, Flashing. See Flashers, Sign.

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Pull Chain, Chain Links, Chain Adjusters, Acorns, Extensions, Insulation Chain Splicers.
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American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Co., Hartford, Conn.

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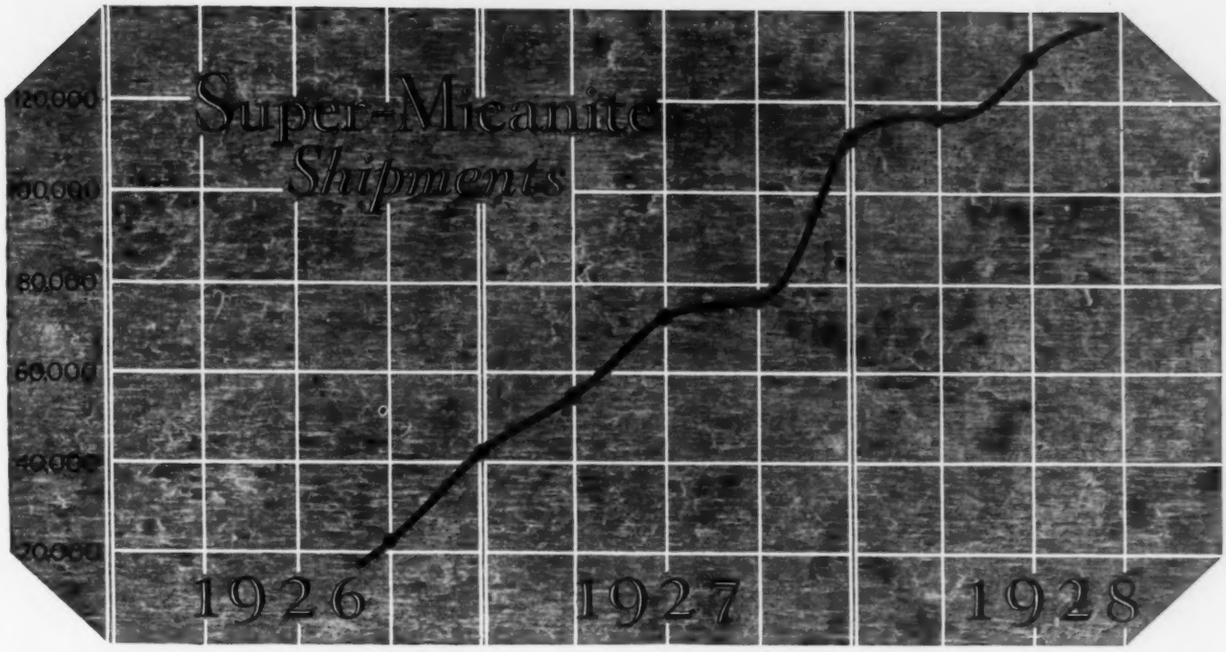

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Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Harrigan, T. M., Woodstock, Vt. (Links.)
Hart & Hegeman Mfg. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr.

SOCKET REDUCERS

Arrow Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key ..... See K
Composition ..... See W
Metal Shell ..... See B
Porcelain ..... See A
Pull Chain ..... See P
Push Through ..... See T
Sign Receptacles ..... See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Co., Hartford, Conn. ..... M C K T P B A
Arrogrip. See Arrow Elec. Co.
Atlantic Elec. Lamp Co., Salem, Mass. ..... K . . P . . .
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C . . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. ..... .
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. ..... A W . . . . . .
Cutler-Hammer Mfg. Co., 1237 St. Paul Ave., Milwaukee, Wis. ..... K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... .
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C . . . . . .
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., Bridgeport, Conn. ..... M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M . . . . . B . .
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. ..... W . . . . . .
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) ..... .
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. ..... M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 70th, New York, N. Y. ..... K . . P . . .
Molded Socket Corp., Railroad, Pa. ..... K . . . . . .
Multi Elec'l Mfg. Co., 210 N. Ogden Ave., Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Paulding, John I., New Bedford, Mass. ..... B A

Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. .....
Quick Catch. See Hubbell, Inc.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... M . . . . . P B . .
Roberts Elec. Mfg. Co., 211 Centre, New York, N. Y. (Candle.) ..... T . . B . .
Royal. See Sears, Henry D.
Safti Soc. See Molded Socket Corp.
Sears, Henry D., 80 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. .....
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
TEC. See Electric Company.
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A
Union Insul. Co., Parkersburg, W. Va. ..... A
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. ..... P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B . .
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P . . . .
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 585 Broadway, New York. (Sign Receptacles.) ..... A
Woodin. See Wood Elec. Co.
Wrinkle. See Bryant Elec. Co.

SOLDER, Aluminum

Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire

Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing

American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Cambridge Smelting Co., Cambridge, Mass.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS

Stick Paste, Flux Salts, Fluid.
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Amco. See American Solder & Flux Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brunner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
General Elec. Co., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leteilier Laboratories, 119 Main St. E., Rochester, N. Y.
Leveridge, Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neer Co., L. F., Butler, O. (Flux and Solution.)
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammonica.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.

Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co.
Superior. See Highland Electro Chemical Co.
Technical Products Co., 116 S. Sheridan Sq., Pittsburgh, Pa. (Paste).
Tinol. See American Solder & Flux Co.
Tixit. See Letellier Laboratories.
Universal Laboratories, University, Va. (Flux.)
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex R.
Yankee. See Leveridge, Chas. W.

SOLDERING IRONS

Acme Elec. Heating Co., Dept B, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
Americal Elecl. Heater Co., Detroit, Mich.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bode. See Baco Electric Co.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., 124 W. 18th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper.)
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
McAdams Co., J. C., Long Island City, N. Y.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., First National Bank Bldg., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Nu-Way. See McAdams Co.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio See Drake Elec. Wks.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Soderwand. See Suttle Equipment Co.
Superior Elec. Products Co., 1300 S. 13th, St. Louis, Mo.
Suttle Equipment Co., Lawrenceville, Ill.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec Heating Co., 225 Varick, New York, N. Y.
Wage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

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SOLENOIDS. See Coils

SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.

SPAGHETTI. See Tubing, Varnished Fabric.

SPEED CHANGING UNITS. See Gears (Speed Changing Units).

SPEED INDICATORS. See Tachometers.

SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS

Airway. See Binks Spray Equip. Co.
Babco. See Simons Paint Spray Brush Co.
Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill.
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Electric Sprayit Co., 320 E. Colfax Ave., South Bend, Ind.
Eureka Pneumatic Spray Co., 87 130th, Richmond Hill, N.Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Little Brown Jug, Inc., Reading, Pa.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Presto. See Metal Specialties Mfg. Co.
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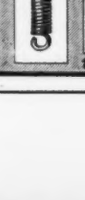
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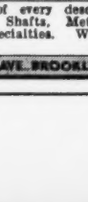
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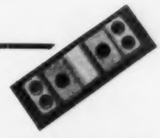

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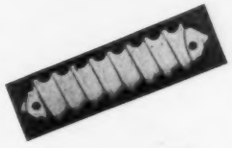

American Lava Corporation
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Manufacturers of
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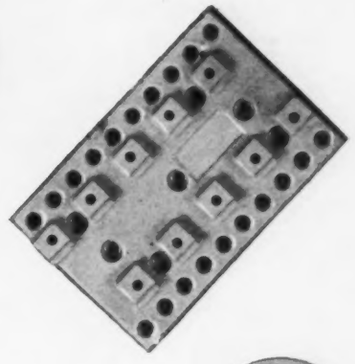

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Sprayit. See Electric Sprayit Co.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.
SPREADERS, COIL & LOOP. See Winding Machines, Armature & Field Coil.

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Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS,
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Cary Spring Works, Inc., 240 W. 29th St., New York, N. Y.
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Farrington & Co., 28 W. Grand, Mt. Vernon, N. Y.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Landsdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.
STAMPED BOXES. See Cabinets, Sheet Steel.
STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel
Heavy Stamping and Drawing.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small
Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee.
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Kelly Brass Wks., 226 W. Ontario, Chicago, Ill.
Kickhaefer Mfg. Co., 359 Reade, Milwaukee, Wis.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Preemax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Reliance Die & Stamping Co., 501 N. La Salle, Chicago.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 6 Howard, New York, N. Y.

STANDS, Armature
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.
STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).
STEATITE. See Cores, Resistance Coil.
STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances
Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet
Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS
Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelee. See Mansfield Sheet & Tin Plate Co.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Mansfield Sheet & Tin Plate Co.
Empire Steel Corp., Mansfield, O.
Manelec. See Mansfield Sheet & Tin Plate Co.
Mansfield Sheet & Tin Plate Co., Mansfield, Ohio.
Metelec. See Mansfield Sheet & Tin Plate Co.

Newport Rolling Mill Co., Newport, Ky.
Polelec. See Mansfield Sheet & Tin Plate Co.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Mansfield Sheet & Tin Plate Co.
Uniloy. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers
Hall-Will, Inc., Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator
Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 1503 Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel
Angle Steel Stool Co., Plainwell, Mich.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separators.
Tools. See Tools, Storage Battery.
STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL
Acme Steel Co., 2840 Archer Ave., Chicago, Ill.
Republic Iron & Steel Co., 335 Market, Youngstown, O.

STRIPPERS, Wire
Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Service Sales & Mfg. Co., 3429 W. 126th, Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).
SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.
SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife
Cut-Out Switches.
Anti-Wood. See Keil & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2801 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Couch Co., S. H., Norfolk Downs, Mass.
Crown. See Edwards & Co., Inc.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.

K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Puritan. See S. H. Couch & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland.
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury
(For Temperature Control Apparatus.)
Absolute Con-Tac-Tor Corp., Elkhart, Ind.
Con-Tac-Tor. See Absolute Con-Tac-Tor Corp.
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Cramblett Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Hywatt. See Cramblett Engr. Co.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.

SWITCHES, Motor Starting
Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
American Elec. Switch Corp., Minerva, O.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
Diamond C. See Standard Elec. Supply Co.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Hill. See Mendell Mfg. Co.
Large-Dall Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Mendell Elec. Mfg. Co., Mattapoisett, Mass.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Safuse. See Federal Steel Products Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Standard Elec. Supply Co., 223 N. 13, Philadelphia, Pa.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegmann & Co., E. M., 3611 N. 11th, St. Louis.

SWITCHES, Remote Control
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

KEY	
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.
Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. . . . . L .
Arrow Electric Company, Hartford, Conn. f s p P R L T
Arrow Head. See Arrow Elec. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . . F
Best. See United States Elec. Mfg. Corp.

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Applications	*Eliminates*
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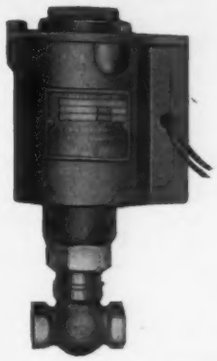

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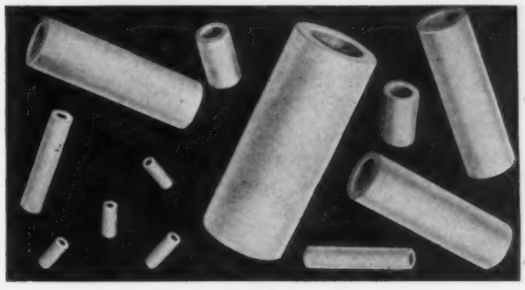

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SWITCHES, Snap—Continued
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. ..... f . . . . . .
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. ..... L F
Bryant Elec. Co., Bridgeport, Conn..... f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. ..... F
Circle F. Mfg. Co., Trenton, N. J..... f . . P . . L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... p P R L F
Crouse-Hinds Co., Syracuse, N. Y..... L . .
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. ..... P . . . . L . .
Diamond Elec. Mfg. Co., 1330 E. 16th, Los Angeles, Cal. ..... R . . .
Diamond H. See Hart Mfg. Co.
Dugle. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... F
Gaynor Elec. Co., Bridgeport, Conn..... f . . . . . L . .
General Elec. Co., Bridgeport, Conn.... f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. ..... F
Hart Mfg. Co., Hartford, Conn..... f sp P R L . .
Hart & Hegeman Mfg. Co., Hartford, Conn. (Door Bolt Control.)..... f sp P R L F
Hart. See Hart & Hegeman Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Harvey, Inc., Bridgeport, Conn.. . sp . . . . L F
Jost. See Morse, Frank W.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y. ..... f . . P . . . . .
Leviton Mfg. Co., 228 Newell, Brooklyn . . . . . F
Levolier. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind..... f . . . . . L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. ..... L F
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y..... s . . R . . .
Morse Co., Frank W., 291 Congress, Boston . . . P . . . . .
National Elec. Controller Co., 8315 Ravenswood Ave., Chicago, Ill..... L F
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. ..... f sp P . . L F
Paulding, John L. New Bedford, Mass.... f s P . . . . .
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. ..... L . .
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... F
Roberts Elec. Mfg. Co., 211 Centre, New York, N. Y. ..... F
Rodale Mfg. Co., 200 Hudson, New York P . . . . . F
Sears, Henry D., 80 Boylston, Boston.. f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. ..... P . . . . .
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill..... f s P R L . .
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L . .
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 114th, New York, N. Y..... f . . . . . .
Victor. See Keil & Son, Francis.
Weber. See Sears, Henry D.
Wood Electric Co., C. D., 565 Broadway, New York, N. Y. ..... F
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.
Arrow Electric Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Penn Electric Machine Co., Des Moines, Ia.
Radiolec. See Cutler-Hammer Mfg. Co.
Sechrist Mfg. Co., Albert, 1717 Logan, Denver, Colo.

SWITCHES, Tank

Automatic Appliance Co., 226 N. St. Clair, Dayton, Ohio.
Automatic Switch Co., 154 Grand, New York.
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Cleveland. See D. J. Time Switch Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Diamond Elec. Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
D-J Time Switch Co., 1306 E. 14th, Cleveland, O.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.

General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 2269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Co., 1 E. 42nd, New York, N. Y.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., 310 N. 11th, Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenten Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elect. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.
TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awebco. See Anchor Webbing Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beledentape. See Belden Mfg. Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves. Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Armature-White. See Boston Woven Hose & Rubber Co.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., P. O. Box 5077, Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okenite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Evergrip. See Boston Woven Hose & Rubber Co.
Firestone Tire & Rubber Co., Akron, O.
General Elec. Co., Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.

THERMOSTATIC METAL
For Low and High Temperatures
Our No. 1800 metal for temperatures up to 450° F.
Our No. 2800 metal for temperatures up to 1500° F.
W. M. CHACE VALVE COMPANY
1600 Beard Avenue, Detroit, Mich.

Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holdfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Magnet. See Boston Woven Hose & Rubber Co.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N Y
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relic. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Security. See United States Rubber Co.
Service. See Boston Woven Hose & Rubber Co.
Slipknot. See Plymouth Rubber Co.
St. Louis Rubber Cement Co., 3952 West Pine, St. Louis.
Star. See Sullivan & Sons Mfg. Co., J.
Sticka. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.
TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.
All-in-One. See Ohio Parts Co.
Barcy-Nicholson Co., 2891 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dante Elec'l Mfg. Co., Bantam, Conn.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., Dept. EB4, 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Fleron & Son, M. M., 113 N. Broad, Trenton, N. J.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kulier Elec. Mfg. Co.
Kulier Elec. Mfg. Co., 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Mfg. Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill.
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments
Ace. See Weidenhoff, Joseph.
Allen-Bradley Company, 493 Clinton, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., G Dept., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co.
Burton-Rogers Co., 857 Boylston, Boston, Mass.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.

PROTECTION!

In a plant organized on a production line basis a single motor failure often entails a larger loss in dollars and cents than the motor is worth.

The plant executive's best protection from interrupted production due to motor failure lies in buying motors on the sole basis of the service that the manufacturer builds into them.

Fairbanks-Morse *could* offer you a *name* which for reliability is unsurpassed by any in the electrical industry as an inducement to buy Fairbanks-Morse Motors. But Fairbanks-Morse prefers that you investigate *comparatively* the *quality* of its product. This company asks that for your protection you look beyond the salesman's price book, that you look beyond the price tag. We ask *that you look at the motor!* We have confidence in our product and your ability to see *quality*.

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Pioneer Manufacturers of ball bearing motors

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Testers, Coil—Continued
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 272 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 477 Broadway, New York, N. Y
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kietzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Meco. See Metropolitan Mfg. & Elec. Co.
Metropolitan Mfg. & Elec. Co., 1163 Sedgwick, Chicago, Ill.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
Illinois Testing Laboratories, 149 W. Austin Ave., Chicago.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.

THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

Absolute Con-Tac-Tor Corp., Elkhart, Ind.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 2 Lanesville Ave., Boston, Mass.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee, Wis.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Leachwood Co., Janesville, Wis.
Manhattan Elec'l Supply Co., New York, N. Y.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Sensatherm. See Mercoid Corp.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermosnap. See Spencer Thermostat Co.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.

TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machinee.
TINSEL. See Wire, Insulated.

TIPS, Cord

Alden Mfg. Co., Brockton, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldentube. See Belden Mfg. Co.
Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
Na-Ald. See Alden Mfg. Co.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S., 415 Saunton, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.

TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Imperial. See Martindale Elec. Co.

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The best in flexible arms for portable and therapeutic lamps, etc.
MADE of steel and brass in all Finishes. Special arms designed to your requirements.
Write for prices.
CHAS. FISCHER SPRING CO.
438 Kent Avenue Brooklyn, N. Y.

Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Equipment & Supply Co., 1638 S. Wabash Ave. Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
Cowie Elec. Co., 1823 Wyandotte, Kansas City, Mo. (Jar Lifting Pliers.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Ibsco. See Illinois Battery Steamer Co.
Illinois Battery Steamer Co., Peoria, Ill.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES

Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.

TORPEDO Cord. See Twine.
TORSION BALANCES. See Instruments, Laboratory Standard
TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Oil Burner.

TRANSFORMERS, Low and Intermediate Voltage

For Oil Burners, Gas Tube Signs, and other special purposes.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elecl. Supply Co., 17 Park Pl., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., 500 W. Huron, Chicago, Ill.
Uptigraft Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.

TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

Controller drive giving a variety of speeds for use in connection with coil taping machines.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.
TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel

Angle Steel Stool Co., Plainwell, Mich.

TRUING Devices, Commutator. See Tools, Commutator.
TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings

Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
British American Tube Co., 233 Broadway, New York.
Bull Dog. See British American Tube Co.
Chase Companies, Inc., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic

Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 146 Colt St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.
Auto-Steelflex. See National Metal Molding Co.

Breeze Metal Hose & Mfg. Co., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Leachwood Co., Janesville, Wis.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber

Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.

TUBING, Varnished Fabric

Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TWINE, Armature Winding; Torpedo Cord

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Winne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.
UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance

Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston,
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Cairod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Farrington & Co., Inc., 28 W. Grand, Mt. Vernon, N. Y.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elecl. Co., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hexwound. See Monitor Controller Co.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Krischer's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
National Elec'l Supply Co., 1323 New York Ave., Washington, D. C.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. G., 407 Bulletin Bldg., Philadelphia, Pa.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2633 Canton St., Chicago, Ill.
Sepco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.

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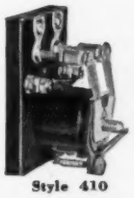

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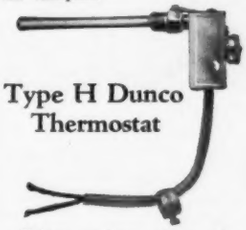

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VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

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Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dual Automatic Valve Co., Rock Island, Ill.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1385 Fulton Bldg., Pittsburgh, Pa.
Jenkins. See Automatic Switch Co.
Liberty Electric Corp., Stamford, Conn.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Zisch Engineering Corp.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y
Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Victor. See Lunkenheimer Co.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)

VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.
VULCANITE. See Rubber, Hard.

VULCANIZERS, WIRE INSULATION

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Biggs Boiler Works, Akron, Ohio.

WASHERS, FIBRE. See Fibre.

WASHERS, Leather

Michigan Leather Washer Co., 548 E. Fort, Detroit, Mich.

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Kickhaefer Mfg. Co., 359 Reade, Milwaukee, Wis.
National Lock Washer Co., Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago

WASHERS, Metallic

Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
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Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.

WATTMETERS. See Instruments.

WAX AND COMPOUNDS

Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound.....See C
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. .. S ..
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill..... W .. ..
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S ..
Clifton Mfg. Co., 65 Brookside Ave., Boston.... C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J..... W S ..
Dielectric Mfg. Co., St. Louis, Mo..... W .. C
Dolph Co., John C., 168 Emmet, Newark, N. J. W .. ..
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Bridgeport, Conn..... W .. ..
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O..... W S ..
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich..... W .. ..
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York..... W .. ..
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind..... C
Minerallac Elec. Co., 1045 Washington Blvd., Chicago, Ill..... W .. ..
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W .. ..
Nu-Blac. See Star Porcelain Co.
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. ..... W .. ..
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seidner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. ..... W .. ..
Sherwin-Williams Co., Cleveland, O..... W .. C
Standard Varnish Wks., 433 4th Av., New York.. W .. ..
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. ..... W S ..
Star Porcelain Co., Trenton, N. J..... W .. C
Tacrite. See Seidner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. ..... W S ..
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. .... S ..
Williams Co., F. M., 1288 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W .. ..

WELDS, Lamp Lead-In. See Filaments, Incandescent

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A. E. F. See American Electric Fusion Corp.
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Ames Co., 115 Ninth, Brooklyn, N. Y.
Atlas. See Railway Track Work Co.
Automatic Trolley Guard Co., 65 Carroll, Buffalo, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Autolite Co., Toledo, O.
Electric Ry. Improvement Co., 2070 E. 61st, Cleveland, O
Electric Welding Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Erico. See Electric Railway Improvement.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fusion Welding Corp., 103rd St. & Torrence Ave., Chicago.
Fuzon. See Fusion Welding Corp.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gesco. See General Engineering.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Indianapolis Switch & Frog Co., Springfield, O.
Lincoln Electric Co., Colt Rd. and Kirby Ave., Cleveland.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
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Rail Welding & Bonding Co., 1615 Collamer Ave., Cleveland.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., Fort & Mt. Elliott, Detroit, Mich.
Taylor-Winfield Corp., 12 Atlantic, Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Toledo. See Thompson.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Welding Materials Co., 114 Liberty, New York, N. Y.
Weldrite. See Electric Welding Machine Co.
Wemco. See Welding Materials Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Winfield Elec. Welding Machine Co., 12 Atlantic, Warren, O.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.
Winding Forms. See Forms, Coil Winding.

WINDING FORMS. See Forms, Coil Winding.

WINDING MACHINES, Armature and Field Coil

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
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Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J
Leesons. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Ridlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J
Weehawken Elec. & Mfg. Co., 543 Gregory Ave., Weehawken, N. J.

WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6102 West 65th St., Chicago, Ill.

WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire:
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding .....See S
Copper Wire .....See C
Iron Wire .....See S
Phosphor Bronze .....See R
Radio Bus Wire .....See C
Resistance Wire .....See R
Steel Wire .....See S

Acme Wire Co., New Haven, Conn..... C .. ..
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa..... C R ..
American Brass Co., 25 Broadway, New York.
American Copper Products Corp., 233 Broadway, New York, N. Y. ..... C R ..
American Electrical Works (Phillipsdale), Providence, R. I. ..... C .. ..
American Insulated Wire & Cable Co., Div. of General Cable Corp., 954 W. 21st, Chicago.... C .. S
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... C .. S
Anaconda. See American Brass Co.
Anylite Elec. Co., Fort Wayne, Ind..... C .. ..
Ballast. See Gilby Wire Co.
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. ..... C .. ..
Belden Mfg. Co., 2310B S. Western Ave., Chicago C .. S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass..... .. R ..
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn..... C .. ..
Calido. See Driver Harris Wire Co.
Celatsite. See Acme Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C .. ..
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa..... C .. S
Cornish Wire Co., 30 Church, New York, N. Y.. C .. ..
Corwico. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C .. ..
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y... C .. ..
Detroit Insulated Wire Co., Detroit, Mich..... C .. ..
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J..... .. R ..
Electron. See Bassett Metal Goods Co.
Excellcier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa.. .. .. ..
Gilby Wire Co., Riverside Ave., Newark, N. J.... .. R
Goldmark Co., James, 83 Warren, New York.. C .. ..
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) ..... C .. ..
Hoskins Mfg. Co., Detroit, Mich..... .. R ..
Hudson Wire Co., Ossining, N. Y..... C R ..
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C .. S
Indiana Steel & Wire Co., Muncie, Ind. .... S
Inland Wire & Cable Co., Sycamore, Ill..... C .. ..
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C .. ..
Monarch Elec. & Wire Co., 622 W. Adams, Chicago C .. S
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark... .. R ..
Nehring Electrical Works, De Kalb, Ill. ..... C .. ..
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn..... .. .. S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. ..... C .. ..
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C .. ..
Pushback. See Acme Wire Co.
Race. See Ross Wire Co.
Roebling's Sons Co., John A., Trenton, N. J..... C .. S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. ..... C .. ..
Ross Wire Co., 69 Bath, Providence, R. I..... C .. ..
Silcrimp. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. .... S
Silchrome. See Alloy Metal Wire Co.
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y..... C .. ..
Standard Alloy Wire Co., Elizabeth, N. J. .... R S
Standard Underground Cable Co. (Div. of General Cable Corp.) Pittsburgh, Pa. ..... C .. ..
Super-Insulated Wire Co., Plymouth, Mass. ..... C .. ..
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C .. ..

WIRE, Copper Clad

American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Pittsburgh, Pa.

WIRE SOLDER. See Solder, Bar and Wire.

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Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Con..

WIRE, Insulated

	KEY
Annunciator, Office, Bell Wire....See	A
Asbestos Covered Heater Cord.....See	H
Asbestos Covered Magnet Wire....See	M
Enameled Magnet Wire .....See	M
Fixture Wire .....See	R
Flexible Reinforced Heavy Duty Cord .....See	F
Heater Cord .....See	H
Ignition Cable .....See	R
Lamp Cord .....See	R
Magnet Wire .....See	M
Rubber Covered Wire & Cable..See	R
Stove Wire .....See	H
Telephone Cord .....See	T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R .. ..
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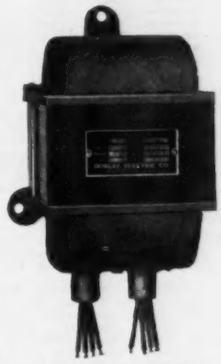

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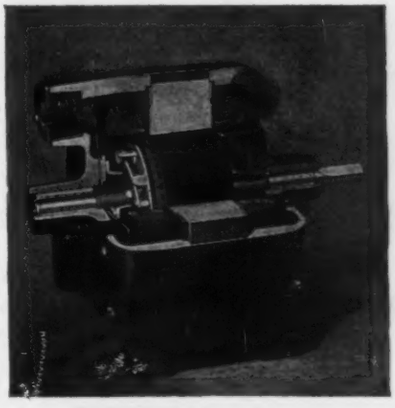

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American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. ..... M
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Ansonia Electrical Co., Ansonia, Conn. Silk, Cotton, Enameled ..... A .. M
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Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
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Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H .....
Bradford, Kyle & Co., Plymouth, Mass. ..... M
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Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .....
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Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa. ..... R .....
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Detroit Insulated Wire Co., Detroit, Mich. R ..... T ..
Diamond Braiding Mills, Chicago Heights R F H .....
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J. ..... R .. H .....
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind. ..... M
Durabilt. See Tubular Woven.
Duracord. See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McElroy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .....
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F .....
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. ..... T ..
General Asbestos & Rubber Co., Charleston, S. C. ..... H .....
General Elec. Co., Bridgeport, Conn. .... R F H .... M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R ..... T ..
Grimshaw. See New York Ins.
Habirshaw Cable & Wire Corp., 10 E. 43rd, New York, N. Y. ..... R .....
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .....
Hazard Insulated Wire Works, Div. of Okonite Co., Passaic, N. J. ..... R F .. A .....
Hercules Powder Co., Wilmington, Del. ..... A .. M
Holyoke Co., 621 Broadway, New York .. R .... A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .....
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .....
Kilo, Co., 2 E. 23d, New York ..... T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. ..... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .....
Loxsteel. See Hazard Insulated Wire Works.
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Montgomery Co., J. R., Windsor Locks, Conn. ..... T ..
National India Rubber. See U. S.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. ..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .....
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co.
Okonite Co., Passaic, N. J. ..... R .....
Ozex. See Simplex Insulated Wire
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Ross Wire Co., 69 Bath, Providence, R. I. R .....
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill. ..... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .....
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .....
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .....
Shield. See Ansonia Elec'l Co.
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .... H .....
Standard Insulated Wire Co., Westfield, Mass. ..... R .. H .....
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R .....
Strand & Sweet Mfg. Co., Winsted, Conn. ..... M
Super-Insulated Wire Co., Plymouth, Mass. ..... M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
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Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn ..... R .....
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .....
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H .. T ..
Whitney Blake Co. See Graybar Electric Co.
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Adamson Machine Co., Akron, Ohio .. I A .....
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A .... S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M .. U ..
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I ..... U ..
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. ..... M .. U ..
Nebutteo. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M S U ..
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I .....
Sleeper & Hartley, Inc., Worcester, Mass. ..... A .... S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M .....
Textile Machine Works, Reading, Pa. .... B .....
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A ..... U F
Utility Mfg. Co., Cudahy, Wis. ..... I .....
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Watson Mfg. Co., Paterson, N. J. .. I A .. M S .. F

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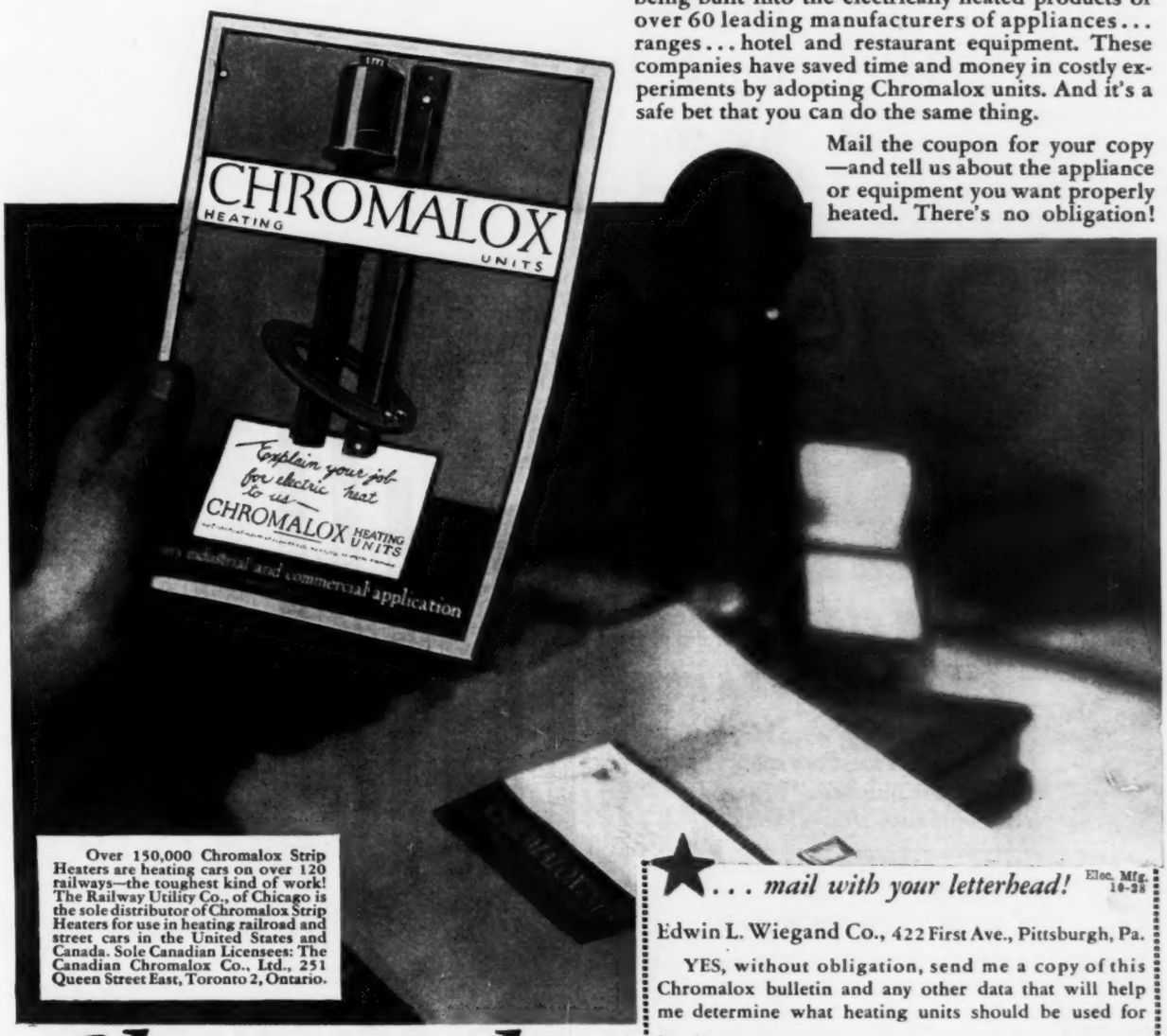

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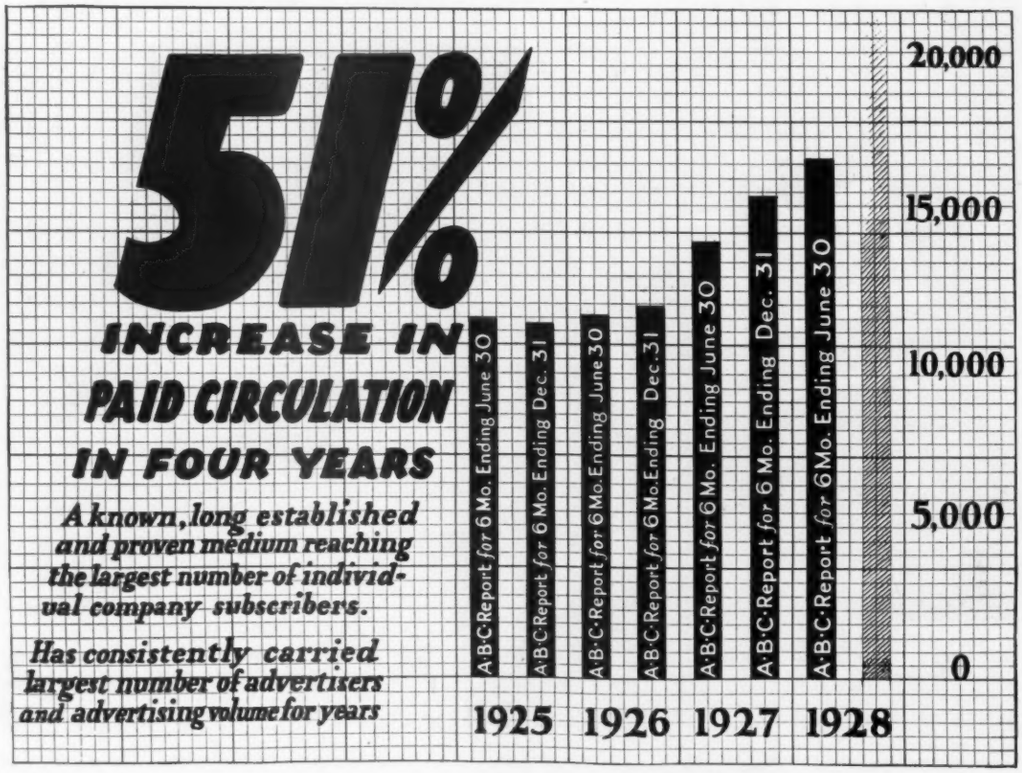
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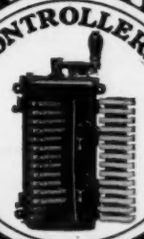

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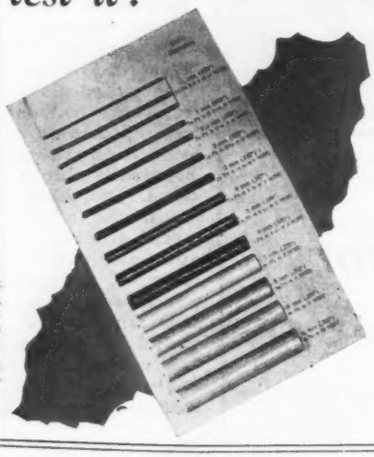

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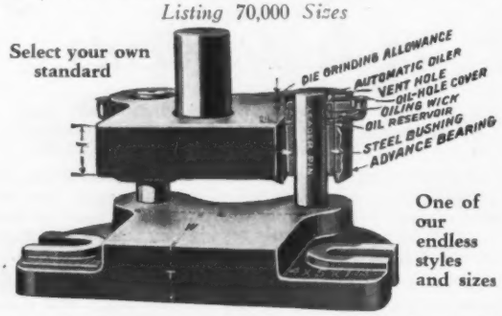

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E. A. BAUMBACH MFG. CO.
GENERAL OFFICE & WORKS
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BRANCH: 1627 WEST FORT STREET, DETROIT, MICH.

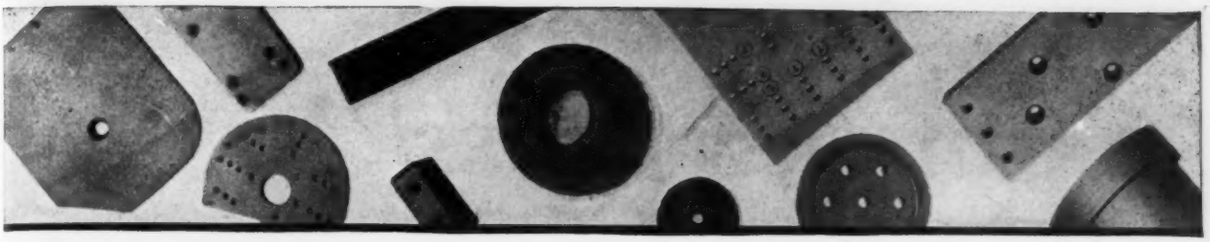
Pure Zinc for Fuse Elements

Strip Zinc for Commercial Uses

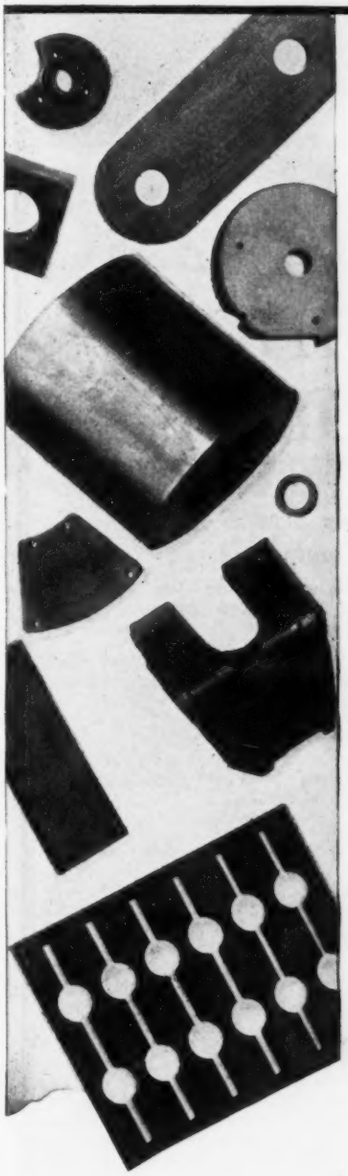
Eyelets Standard & Special

Large Articles Made on Multiple Plunger Press

The Platt Bros. & Co.
Waterbury, Conn.



Moulded into thousands of shapes



ASBESTOS EBONY

Lends itself to a great variety of uses

THE uniform, monolithic nature of Johns-Manville Asbestos Ebony results in a material which can be used where precision must be combined with high dielectric resistance, structural strength and resistance to moisture.

Moulded into thousands of shapes Asbestos Ebony is used in a wide variety of electrical machinery and equipment.

J-M Asbestos Ebony in moulded form gives the same service which has resulted in its use for huge switch panels. We welcome inquiries from manufacturers of electrical devices of every sort. We are ready at any time to estimate on moulded material.

Address Electrical Section, Johns-Manville Corporation at New York, Chicago, Cleveland or San Francisco.

JOHNS MANVILLE SERVICE COVERS THE CONTINENT

MASTER *of* ASBESTOS

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ASBESTOS EBONY

"On the press!"

Something you have felt the need of for a long time— a guide to successful selling in the foreign markets—

"ELECTRICAL EXPORTING AT A PROFIT"

"How an Electrical Manufacturer can develop and maintain an Export Business—proven practices"

THIS booklet will shortly be ready for distribution to a complimentary list. A request form has been mailed you—if you have not received it, write today to—

Electricidad en América

The only electrical export paper printed entirely in Spanish

Published Monthly by

GAGE INTERNATIONAL PUBLISHING CORP.

461 Eighth Avenue, New York, N. Y.

"Handy" Silver Solders

Standardized to 12 Formulas

FIVE years of intensive effort have enabled us to STANDARDIZE silver solders for the first time in history. How important this is will be appreciated when we explain that our tests have so *simplified* the whole silver solder problem that we have reduced several hundred formulas formerly used, to

Only 12 Standard Mixtures

These differ from each other mainly in the percent of silver present. Solders highest in silver fuse at 1325° F., while those lowest in silver fuse at 1600°. Between these two extremes the fusing point varies with the silver ratio.

These twelve formulas are now offered in suitable forms—sheet-strip, wire, filings, etc.—for prompt shipment.

* * *

The use of silver solders is rapidly increasing in a wide range of metal-working industries. They are solving a multitude of soldering and welding problems.

CHARACTERISTICS	*METALS THEY SOLDER*	
1. Low melting point	Silver	Saw Steel
2. Free flowing properties	Brass	Strip Steel
3. Affinity for other metals	Bronze	Stainless Steel
4. High tensile strength	Copper	Cutlery Steel
5. Ductility—malleability	Nickel	Tool Steel
6. Resistance to shocks	Monel	Alloy Steel
7. Ability to withstand vibration		
8. Resistance to corrosion	In fact all metals fusing above 1400° F.	
9. High electrical conductivity		
10. Small quantity necessary		

Let us help you solve your soldering problems

Send parts you solder in quantities to our Bridgeport, Conn., plant and write fully. We will make all necessary experiments and tests, without expense to you—and will make our recommendations promptly.

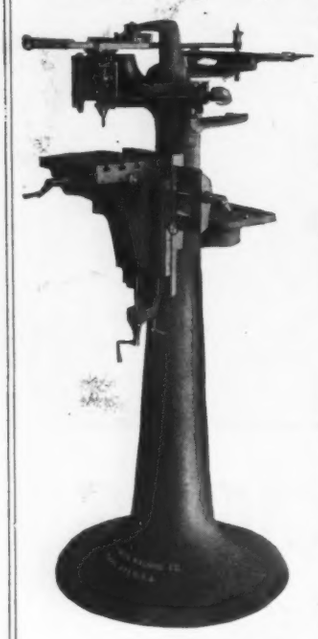
Send for our Handy Book of Silver Solder E.

HANDY & HARMAN
EXECUTIVE OFFICES
57 William Street, New York

PLANTS:
Bridgeport, Conn.—Providence, R. I.—Fulton and Gold Sts., N. Y. City

Above Illustrations are from our Bridgeport Plant

Keeping Up With Orders



The rapid strides being made in the ELECTRICAL field demand equipment capable of keeping up to the call for parts. The

GORTON Engraving Machine

stands out prominently on such work. Its rapid action, easy manipulation and unerring precision make it an invaluable tool on small engraving jobs. It is made in different sizes and styles, suited to a vast variety of work. Tell us what you make and we'll show you how to save in the making.

SEND FOR CATALOG

GEO. GORTON MACHINE COMPANY
Racine, Wisconsin

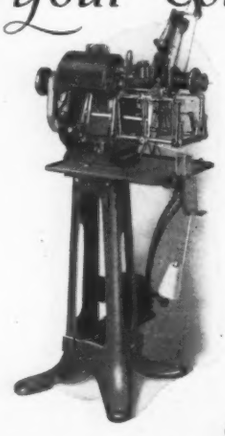
You may have a special metal problem which we can help you solve

There is usually one best metal for every manufacturing requirement. The American Brass Company, through its Technical Department, is prepared to help determine what this metal is, and if the need is met most advantageously with copper or an alloy of copper, to supply the metal in uniform, dependable quality.

THE AMERICAN BRASS COMPANY
General Offices ~ Waterbury, Conn.

ANACONDA COPPER
BRASS ANACONDA BRONZE

Your Coil Problem Solved!

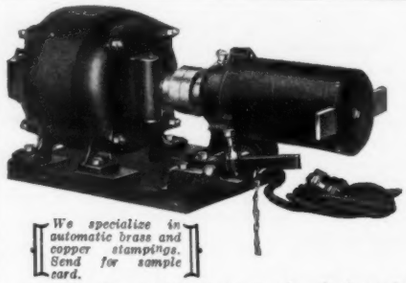


Install a group of
"*Universal*"
Coil Winding
Machines
and insure
uniform production
of dependable coils
at surprisingly
low cost

or

Purchase these same coils from us, carefully wound to your specifications and ready for application to your product

UNIVERSAL WINDING COMPANY
Lesson
BOSTON



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The unqualified success of the

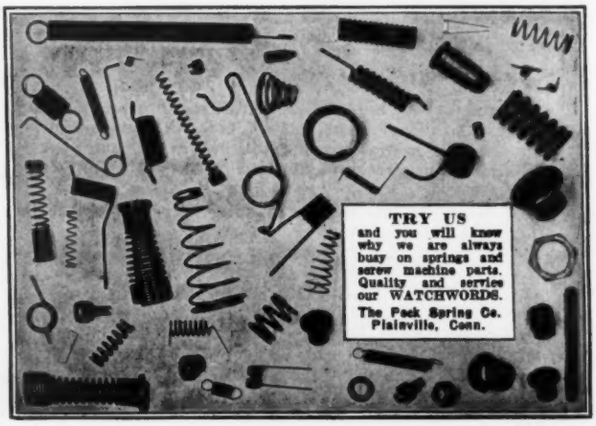
Zierick Wire Stripper

—is due to its faultless, noiseless operation, easy adjustability to any size of wire and length of insulation to be removed.

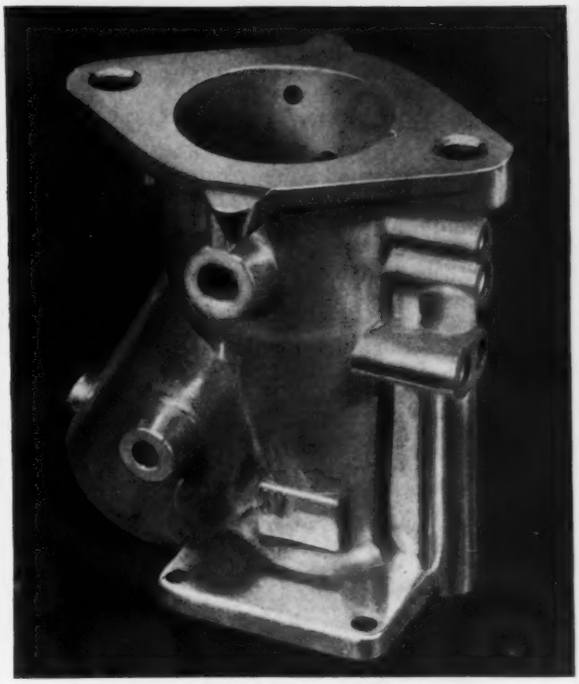
Send us samples of your wires and we will show you how this machine will save your time and labor.

Sent on trial to any manufacturer with approved credit.

F. R. ZIERICK MACHINE WORKS
6 Howard St., New York, N. Y.


TRY US
and you will know why we are always busy on springs and screw machine parts. Quality and service our WATCHWORDS.
The Peck Spring Co.
Plainville, Conn.

Match production to the new buying habits with the help of Stewart service...



Stewart Die Casting service produces many definite advantages in the manufacture of hundreds of different types of product, each advantage contributing to the major feature of overall economy.

Production economies include:

Reduced unit costs
Simplified design
Complete interchangeability and simpler, faster assembly
Release of manufacturing facilities for other work
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Fewer adjustments and less "free service" required
Improved performance as a result of detail improvements possible with the Stewart Die Casting process

Stewart engineers are specialists in die design and in the adaptation of products to production as die castings. Their services are available to manufacturers without charge. The Stewart plant is the largest in the world devoted exclusively to die casting. Automatic machinery, principally of Stewart design, and an organization highly trained in the Stewart process insures economy, accuracy, and unrivalled standards of service.

PRODUCTION of parts by the Stewart Process of Die Castings helps meet present-day buying habits economically. No longer is it necessary to manufacture complicated pieces in large quantities for stock. Produce these parts as Stewart Die Castings, gauge production by demand from month to month, if necessary, and still you may be sure of prompt deliveries for Stewart facilities are ample for large volume production on short notice.

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Cut Your Costs Improve Results

Even at the same price as you now pay Wolverine 98.85+% pure Seamless Copper Lugs will save you money—because they fit closely with less solder; are clean and true; and are free from defects. Your customers will profit from the higher conductivity and freedom from failure. Send for quotations on any sizes and all quantities.

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F. B. Distributing Co., 801 Stephenson Bldg., Detroit, Michigan

A. L. Gillies, 208 King St., Toronto, Ont., Canada

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Wm. A. MacAvoy, Jr., 244 N. 10th St., Philadelphia, Pa.

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William M. Orr Co., 1411 Brighton Road, Pittsburgh, Pa.

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H. B. Squires 721 East Ninth St., Los Angeles, Cal.

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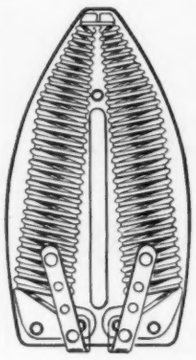

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Can be used on all 6 lb. irons wherever a mica element is used

Clear India Mica

Nichrome Wire

Special Price to Electrical Manufacturers

Buffalo Products Co.

Broome & Lafayette Streets

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HARTMAN Wire Stripper

NEW AND IMPROVED

For ease and safety in operation, the HARTMAN Wire Stripper stands alone. It does a complete job, stripping the wire of insulation, and twisting and polishing it, all in one operation. It increases production and cuts costs. We back it with an unconditional one year guarantee against defects in material and workmanship. Send for full details at once.

Sold only by

THE SERVICE SALES & MFG. CO.

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18 shipped to one customer in July. Repeat orders make up more than 50% of our present production.

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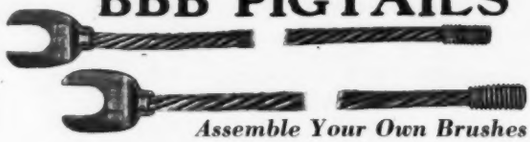

Assemble Your Own Brushes

BBB Pigtails can be installed in a brush at a few moments' notice. Brush is drilled at point leader is wanted, hole tapped with correct thread and Pigtail screwed in by hand or pliers. It makes a perfect mechanical as well as electrical connection. This is proven by years of service in actual hard usage.

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BECKER BROTHERS ELECTRIC CORP.

Manufacturers of BBB Carbon Brushes

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E-Z WIRE STRIPPER

A HANDY TOOL *for all* MANUFACTURERS

Here is a tool that will save you time and money, speed up production and lower your costs.

This inexpensive tool strips wire of 10 to 20 gauge 20 times faster than usual methods. Give it a trial on a money back guarantee. Thousands in use.

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Magnet Wire Built to Withstand Exacting Tests

DELTABESTON W. E. finish magnet wire is insulated with pure, long-fibre asbestos. It is absolutely true and even in the outside diameter, thus assuring the same number of coil turns as double cotton covered magnet wire. The asbestos insulation is felted on the conductor and adheres tightly without the aid of cotton threads. After pressing, it is baked at a temperature that will carbonize cotton, leaving an insulating wall of pure asbestos.

Deltabeston magnet wire is your assurance of reliable protection for headlight generating equipment, motors, generators, brake coils, lifting magnets and other electric apparatus.

There is only one way to *prove* the value of any product—test it and compare it with similar products. Because Deltabeston magnet wire is different, we want you to subject our samples to the severest tests you can devise. See for yourself that it is absolutely fireproof, tough, easy to handle and entirely dependable. Request samples from:

DELTABESTON
Magnet Wire

FOR

Headlight Generating Equipment
Axle Lighting Generating Equipment
Motors—Generators
Brake Coils—Lifting Coils and other Electrical apparatus.

YORK INSULATED WIRE WORKS *of*
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The best for Electric Heating Appliances

Our clay specialties, plain and threaded tubes, and Refractory Porcelain for Electric Heating Appliances are superior in every way; and "PORCELAVA" makes the best Pyrometer Insulation.

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. . . service on a quantity production basis in screw machine work.

Metal parts for radio condensers, metal inserts for moulded products — countless other items. Send sample or sketch for estimates. Our prices are not the lowest but we guarantee the quality of our workmanship.

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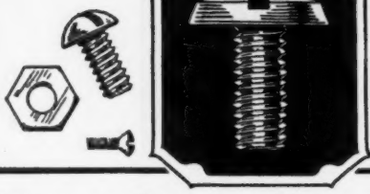

All kinds of Electrical Screws carried in stock
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NEW ENGLAND SCREW CO.
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For Better Washers

OF BRASS, STEEL AND COPPER
Highest quality—Low prices
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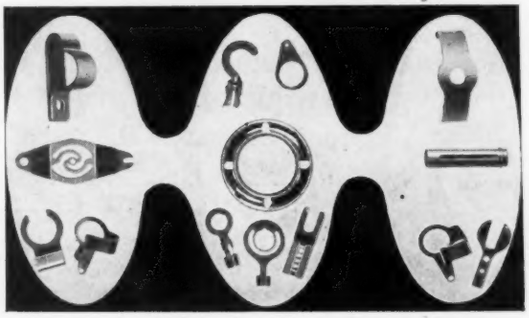
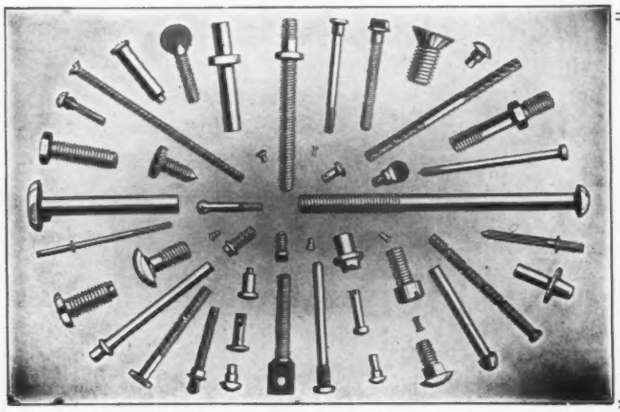
MASS. MACHINE SHOP, INC.
BOSTON, MASS.

FLAT, FORMED AND DRAWN
SMALL METAL STAMPINGS



PATTON-MacGUYER CO. PROVIDENCE, R. I.



WHEN IN NEED OF

MACHINE SCREWS
MACHINE SCREW NUTS
SPECIAL STUDS
SPECIAL SCREWS

COMMUNICATE WITH
THE HOUSE OF SERVICE

THE PROGRESSIVE MANUFACTURING CO.
TORRINGTON, CONN.

We please those discriminating manufacturers who not only demand quality but service as well. Business goes where it is invited and remains where it is well treated. The illustration reveals a few only, of the possibilities that are developed by the cold heading process.

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You cannot afford to use any but the *best* copper, Zinc or alloys in your products. Our specialty is making Rolled Brass, Bronze, Phosphor Bronze, Copper, Zinc, German Silver and other alloys in sheets ⅛″ to 15″ wide and .001″ thick or thicker. The finest quality and accuracy is guaranteed.

Brass, Copper, Phosphor Bronze & Special Alloys

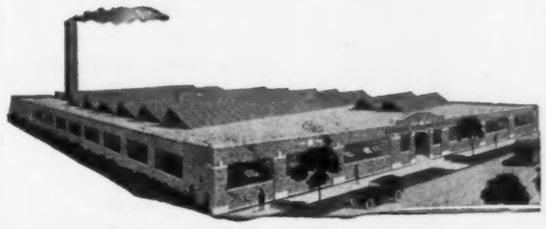
Hot Tinned or Plain

Our experience and counsel may help to furnish you with a more satisfactory metal for a given purpose at a lower cost. We have done that for many electrical manufacturers of varied needs, and we will be glad to hear from you.

The Baltimore Brass Company

1212 Wicomico Street, Baltimore, Md.

Name Plates



OUR LARGE AND MODERN PLANT—BUILT TO MEET THE GROWING DEMAND FOR OUR QUALITY PRODUCTS.

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General Etching and Mfg. Co.
MANUFACTURERS OF
ETCHED AND LITHOGRAPHED METAL PRODUCTS

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Think about selling but don't forget *production*

By all means think about sales and distribution—modern competition demands elimination of waste in those departments.

This is likewise true in production. Alertness there is more important than ever. Yesterday's machines are obsolete today. Today's methods will be obsolete tomorrow. Eternal vigilance is the price of survival.

Especially active are present changes in power generating and power using equipment. Machinery, instruments, tools and materials—all have progressed during the past year.

To keep abreast of these changes leading executives and their engineering assistants regularly visit the annual National Exposition of Power and Mechanical Engineering.

Be sure your production and plant operating men attend; you, yourself, should attend. Four floors of exhibits by leading manufacturers will await your careful inspection at Grand Central Palace, New York, December 3 to 8.

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We have manufactured and supplied glassine paper for insulating to the Electrical Trade for 25 years.

Made in various thicknesses
.00065" and up
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Sheets and perfect rolls
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On contract orders will carry your paper in stock so that we can make immediate shipment when required.

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Motor repair shops specify

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TRADE MARK
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because it's STANDARD

Anchor Webbing Co.
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ALUMINUM DIE CASTINGS
For Strength, Lightness, Economy
Reduce assembly costs—
speed up production—

A specialist will consult with you on request. No obligation, of course.

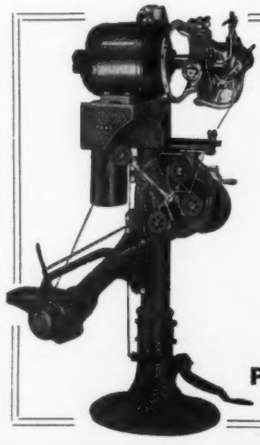
ALUMINUM COMPANY OF AMERICA
2471 Oliver Building Pittsburgh, Pa.

Try this on your washing machine

Instead of the old tune of "START—STOP—RACK—WRENCH," try the ONEIDA Flexible Coupling on your washing machine. This simple little device absorbs the shock of sudden starting and stopping and adds years to the motor's natural life. It should be standard equipment on all washing machines; and it is also a life-saver for oil-burners, ironers, refrigerators, etc. We would like to tell you more about it.

DELBEE RUBBER CO.
Syracuse, N. Y.

ONEIDA
FLEXIBLE COUPLING
for *every* direct-connected appliance



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PRODUCING CAPACITY
and quick
ADJUSTABILITY
The CHAPMAN
Style 3 Bipolar Drum
ARMATURE WINDING MACHINE
is in use
ALL OVER THE
Civilized
WORLD
P. E. Chapman Elec'l Works
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MW Lee Springs

Lee-Built Springs are designed to fit your special purpose. They are made from all spring materials and in all sizes. Inquiries invited.

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RAW MATERIAL
WELL DONE
STANDARDIZE
FOR YOUR
ELECTRICAL
REQUIREMENTS
ON
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Precision Work plus Timely Service
METAL PRODUCTS
Wire Forms
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Machine Screws
Battery Connectors
Screw Machine Products
Clark Metal Products, Inc.
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MARING WIRE COMPANY
MUSKEGON MICHIGAN
MARINGRAM
MARING PROCESS
"YOU CAN'T RUN A MOTOR WITH APPLESAUCE ANY BETTER THAN YOU CAN PAINT A HOUSE WITH IT."

AND quite true this is when it comes to Magnet Wire. You can't afford something "just as good" when you can easily get the unequalled quality of MARING Magnet Wire.

Motors won't run "just as well," either, with a "just-as-good" wire. And the repair job always comes a whole lot sooner with an inferior wire.

Why handicap a good motor with a poor wire? Isn't it better to play safe and use "MARING," than to wish you had?

Let us analyze and quote you on your requirements. One of our nine Branch Managers is ready to serve your inquiry. Call him in.

MARING WIRE COMPANY
MUSKEGON, MICH., U. S. A.

MARING Magnet Wire

LACQUERS AND LACQUER ENAMELS

M&W Co 1876

AVOID UNCERTAINTY!

You cannot afford to take chances on your finish.

M & W Lacquers and Enamels are being used by an ever increasing number of manufacturers of Hardware and all other Metal products.

Quality, Reliability and Uniformity represent the background upon which they base their selection.

We invite your correspondence regarding your particular problems.

Maas & Waldstein Co.

Executive Offices and Plant
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NEWARK, N. J.

Chicago Office and Warehouse: **1115 Washington Blvd. West**
Los Angeles Office and Warehouse: **1212 Venice Blvd.**

Are You Seeking Selling Connections for Distribution of Your Product to

Electrical and Automobile Manufacturers?

If so, we can do an efficient selling job for you. A successful sales organization enjoying long established contact and outlets among electrical and automobile manufacturers, we want additional lines of reputable companies, on commission. Address Box Number 250, care ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York, N. Y.

The Truth about Zellac Colors

ZELLAC colors agreeably meet the public demand because they are *bright*—with a sparkling richness. Because of their *clarity*—giving them a distinctive life and depth. Because of their *variety*—in every subtle trend of color-shades. *Because Zellac color supremacy has been attained without any sacrifice of other lacquer qualities!*

Our color experts keep *ahead* of the conventional ideas. That's why we are always ready to supply any unusual color combinations desired.

Color is important to you as a present-day sales factor—but not more important than the durability and quality that has been so successfully combined with economy in Zellac Lacquers. Let us deliver you a trial order of Zellac formulated on the basis of our experience as lacquer makers since 1886—specially formulated to whatever requirements you wish us to meet. Thereafter you have a definite assurance of uniformity at a distinct saving.

ZELLER LACQUER MFG. CO., Inc.

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DENVER: Ormor Sales and Supply Co. 503 Fourteenth Street. *Distributors*
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SAN FRANCISCO: 1039 Harrison St.
SEATTLE: 2108½ First Avenue
DALLAS: Ormor Sales and Supply Company of Texas 408 North Lamar Street. *Distributors*

ZELLAC

Information Wanted

We have been asked for the names and addresses of manufacturers of the items listed below:

"Splendida" Electric Iron
"Sal Co. 176" Lamps
"Electron" Heating Pad
"Blaisdell" Automatic Electric Cigar Lighter
"L. R. Co." Receptacles
"Lily Wilson" Vacuum Cleaner
"Packard" Vacuum Cleaner
"Perkins" Siren
"Wharton" Battery Charger
"Flint" Waffle Iron
"Patrician" Line of Lighting Fixtures, asked for in our September issue, is manufactured by Patrician Art Metal Corp., 229 9E. Maryland St., Indianapolis, Ind.
Address of Dura Electric Appliances (Manufacturers of Curling Irons)

Replies from our readers to any of these inquiries will be greatly appreciated by ELECTRICAL MANUFACTURING, Printing Crafts Bldg., 461 Eighth Ave., New York, N. Y.

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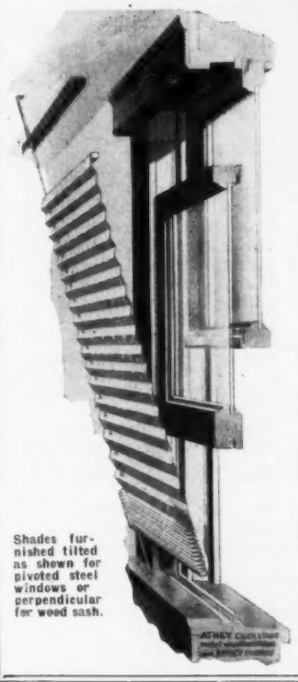
to sit in a cold, drafty room where you would not wish to work yourself?



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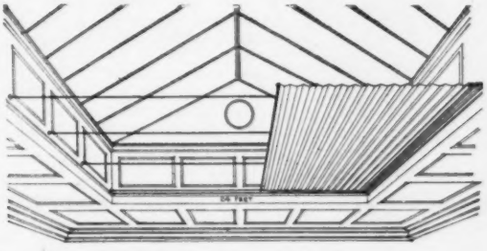

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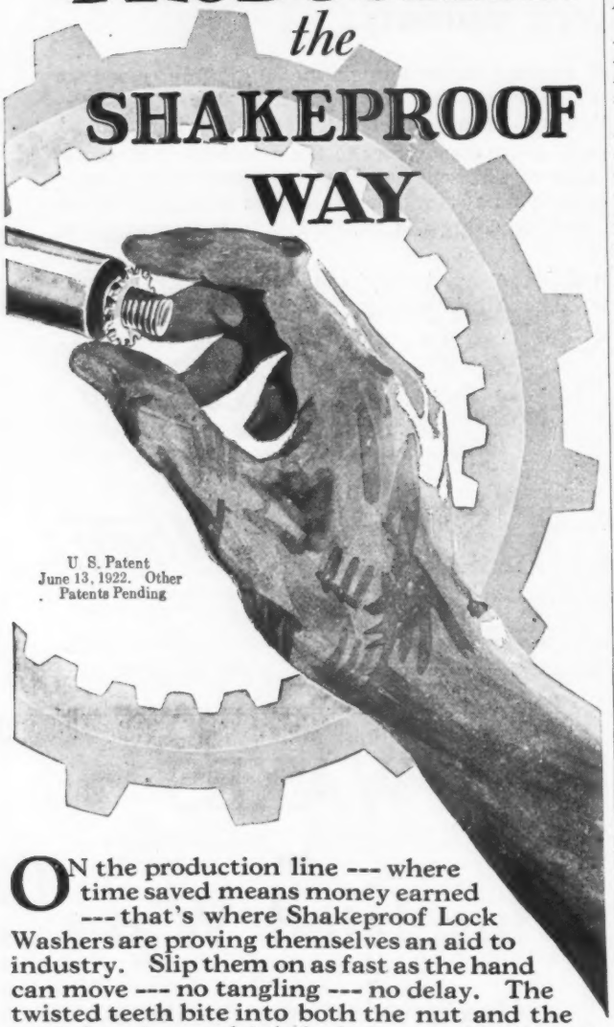

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